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I dedicate this thesis to my wife Gabriela.

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Abstract

Environmental management systems in organizations in general and in universities in special are normally analyzed based on technical or ecological considerations. Legal compliance of the applicable environmental legislation is another common concern. In the context of implementation and setup of environmental management systems organizational aspects are normally not fully developed. In our analysis we will apply system theoretic considerations on the environmental management standards EMAS and ISO 14000 (in representation to the different approaches that can be chosen in for environmental management systems) in order to introduce them into organizational complexity. With the help of organizational theory we will develop a simple model that we will apply on the environmental management system of the Autonomous University of San Luis Potosi.

Key words: Environmental management systems, change management, organizational learning and universities.

Los sistemas de manejo ambiental en organizaciones en general y en universidades en especial se analizan generalmente bajo consideraciones técnicas o ecológicas. El cumplimiento con la legislación aplicable es otro punto que destaca en este modo de observación. En consideraciones de implementación y diseño de sistemas de manejo ambiental los aspectos organizacionales no se incluyen de forma extensiva. En nuestro análisis se aplican consideraciones basadas en la teoría de sistemas a los estándares EMAS e ISO 14000 para abrir un panorama de complejidad en las organizaciones. Con la ayuda de consideraciones que se basan en teorías organizacionales se desarrolla un modelo simple que se aplicara al sistema de manejo ambiental de la Universidad Autónoma de San Luis Potosí – México.

Palabras claves: Sistemas de manejo ambiental, manejo de cambio, aprendizaje organizacional y universidades

Umweltmanagement Systeme in Organisationen im Allgemeinen und Universitäten im Speziellen, werden meist unter technischen und ökologischen Gesichtspunkten untersucht. Ein wichtiger Aspekt ist hierbei sicher auch der legale Aspekt der mit der jeweils geltenden Rechtsprechung im Zusammenhang steht. Organisationelle Gesichtspunkte die im Zusammenhang mit dem Aufbau und der Einführung von Umweltmanagementsystemen stehen werden meist nur am Rande betrachtet. Stellvertretend für die verschiedenen Möglichkeiten eines Umweltmanagement Systems möchten wir mit Hilfe der üblichen Umweltmanagementstandards EMAS und ISO 14000 in Verbindung mit systemtheoretischen Überlegungen die organisationale Komplexität erarbeiten. In Verbindung mit organisationstheoretischen Überlegungen werden wir ein einfaches Modell erarbeiten, das wir anschließend auf den speziellen Fall des Umweltmanagement Systems der Universidad Autónoma de San Luis Potosí in Mexiko anwenden werden.

Key words: Umweltmanagement Systeme, Change Management, Lernende Organisationen und Universitäten

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1 Introduction

1.1 Structure of the report

Literature on Organizational Change, Change Management, Organizational Learning, Organizational Development, etc. is in a way abundant that it is impossible to review this research stream in a comprehensive way. However, there is not too much literature and research on organizational change in organizations of higher education available. But also within this research stream we did not an extensive literature review. Within the reviewed stream of literature it is highlighted that organizational practice and setup are different from other types of organizations like enterprises or companies. Especially differences in the organizational structure, leadership and decision schemes, value and incentive system, make research results from other organizational systems difficult to apply directly. Therefore, the concepts of sustainability, organizational change and learning have to be adapted to the specific characteristics of institutions of higher education. The line of argument that we will develop will concentrate on aspects that should be found in every organization after the adaption to every special case.

The assessment of organizational ecology issues has developed over time to the definition of environmental management standards. The environmental management standards rely on experiences of the past. As they develop through experience and through the fact that certain aspects have shown to be successful in the past they generalize this experience to be successful in the future. The downside is that research on success factors has not shown to have predictive value. It cannot be assumed that the implementation of environmental management systems leads directly to a continuously improving environmental performance of the implementing organizations. Due to the technical nature of the environmental management standards we expect the organizational dimension of the implementation to be developed to a lower degree than the directly environmental aspects.

We will analyze the environmental managements standards EMAS and ISO according to the relation these standards see between organization, society, physical environment and their employees. Further, we will analyze how the standards see the organization of the

organization and what aspects they focus in for implementation. For this analysis we rely on system theoretic considerations.

After a section where we review the organizational consequences of an environmental management system implementation, where we develop the need for special attention for the management of the implementation, we will review literature on strategic management. For our analysis we will focus on the revision of the resource-based view.

We will apply models of organizational development on the considerations of the resource-based view in to develop a simple model of implementation.

From this model we derive requirements for change management and organizational learning. After a short review or overview of applicable theory in these two areas we will apply our model to the case of the Autonomous University of San Luis Potosí – Mexico.

1.2 Sustainability in Higher Education

1.2.1 Sustainability and University

“Sustainable development, although a widely used phrase and idea, has many different meanings and therefore provokes many different responses. In broad terms, the concept of sustainable development is an attempt to combine growing concerns about a range of environmental issues with socio-economic issues” (Hopwood, Mellor, & O'Brian, 2005).

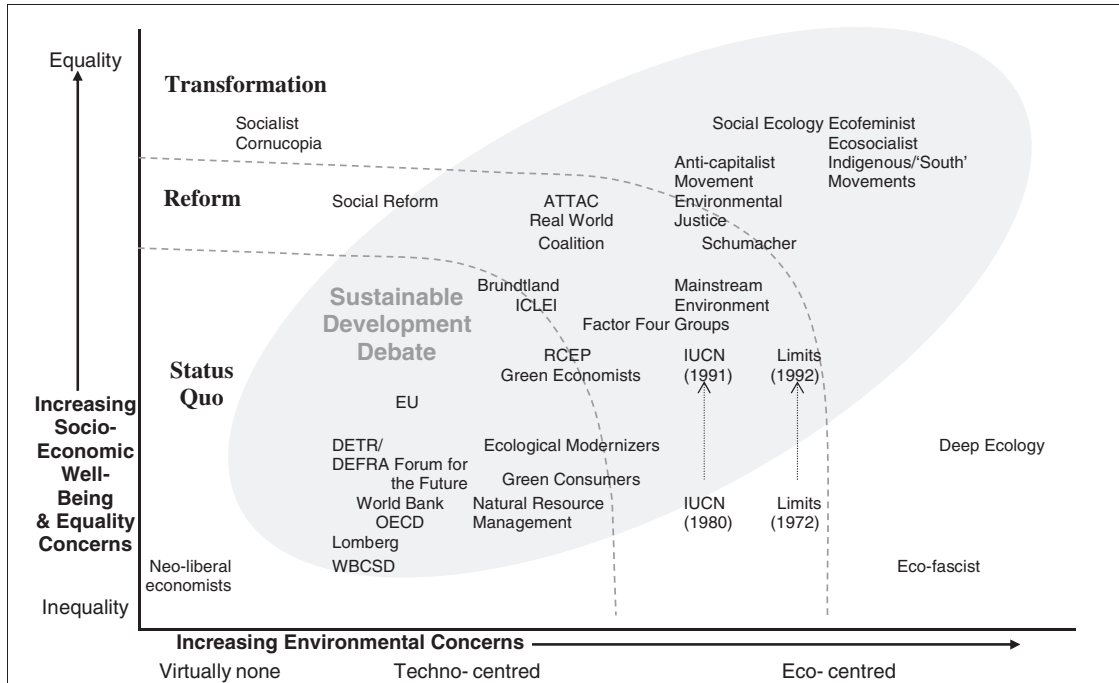


Figure 1: Map of the sustainable development debate, referring to degree of environmental vs. socio economic concerns (B. Hopwood, 2005).

The understanding of the term “sustainability” differs widely between e.g. Eco Fascists, Neo Liberalists, Social Reformers, ... (see figure 1). It is mostly agreed that society, economy and environment plays some part in it but the role (such as good or bad, worth to sustain or maybe better not to sustain) and the degree of importance of each aspect (differs greatly).

In the university context, or for the implementation of sustainability ideas, the issue of what is understood or addressed with sustainability plays an important role. Sustainability as vision, target or end needs to be assessed within the university.

The emphasis the university puts on different aspects depends also on the relevant societal environment of the organization. Swedish Universities tend to emphasize the environmental aspect as “In Sweden, the concept of sustainable development is often equated with environmental efforts. This is because social and economic dimensions have long been emphasized in politics and societal development, while ecological concerns have had a lower priority” (von Oelreich, 2004). Within the organizational system of the

University of Florida a different access to sustainability was found. For his university Newport reports that “historically, sustainability proponents have done little to disabuse the apparent environmental supremacy of our approach... [and] by touting sustainability’s three legs solely as the means to solve environmental woes, we leave social and economic constituencies out of the picture.” (Newport & Lindner, 2003) Further they claim that “while there are various spins on sustainability, it does not appear to be a unifying theme that is instinctively understood and communicable by disparate demographics” (Newport & Lindner, 2003) They see “part of the problem [as] sustainability’s stilted vocabulary; part of it is an artifact of its green genesis” (Newport & Lindner, 2003).

Futhermore, “sustainability” is also a changing target over time. Its roots are based in environmental objectives and understanding while in recent times economic and societal issues are getting more and more into the focus. Many “greening the campus” initiatives have changed to sustainable university programs.

In one of numerous ongoing national and international initiatives, the Talloirs Declaration (an initiative that started in 1990 an is now followed by the association of university leaders for a sustainable future- ULSF), the importance of the universities is seen in the role that “Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies” (Shriberg & Tallent, 2003). Orr cited by Gutz affirms that, “no institutions in modern society are better situated and none more obliged to facilitate the transition to a sustainable future than colleges and universities” (Gutz, 2004).

There are various areas in which universities should support sustainability; the Talloirs declaration defines them as “... intentionally broad, covering the major areas of university activity: teaching, research, operations, outreach and service” (Shriberg & Tallent, 2003).

But not only the ideal or idea or environmental necessity is a driver in the implementation of sustainability. A survey carried out in North American Universities by Shriberg found out “... Talloires Declaration signatories are most likely to pursue

sustainability because of the potential benefits to reputation, cost savings/finances, and regulatory pressures ” (Shriberg & Tallent, 2003).

1.2.2 Sustainable University dimensions / field of action

Following the idea of autopoietic systems, from a system rational point of view survival is the systems primary concern. Universities have to, at first, be able to sustain themselves. On one hand they need to teach and research on relevant topics so that students are willing to study in the university and on the other hand they need to do this in an economic way so that their financial survival is secured and student interest is maintained. Research that might serve as an example made by Comm and Mathaisel assesses lean principles in several North American Universities. They found that on an operational basis “since almost any college or university is a collection of smaller departments, offices and divisions, there is ample opportunity for eliminating waste and redundancy and focusing on the core competencies of the institution: teaching and doing research” (Comm & Mathaisel, 2006).

1.2.2.1 Curriculum

Universities are the dominant organizations of higher education. The topics taught in the different areas, schools and departments are fixed in the respective curricula or syllabus. In the end, what the students learn is fixed and defined by the covered topics in the curricula. The highest leverage for promotion of sustainability can be found in the education of the students. To include sustainability in the curricula is most important in order to have an impact on external social systems. The UN Conference on Environment and Development document (Rio de Janeiro 1992) targets this point in its chapter 36 (BMU, 1992).

There are a lot of examples of how sustainability can be targeted in different course programs: accounting students are being taught about their role in corporate social responsibility (Leigh, 2004), quality management is used as a bridge in educating sustainability in business schools (Rusinko, 2006), a planning class brings sustainability concepts to Columbus Ohio (Conroy, 2004), the importance and considerations on educating engineers in sustainability are targeted (Boyle, 2004), applying community based research and service learning, students learn sustainability and economic development in an applied context (Keen & Baldwin, 2004)...

Consequently in their investigation about Talloirs, signees Shriberg and Tallent state that “a common environmental strength is curriculum development, although requiring basic ecological literacy is not on the agenda of most campuses” (Shriberg & Tallent, 2003).

Although the Technical University of Catalonia has incorporated sustainability in most of its course programs (Ferrer-Balas, 2004) and the Mälardalen University in Sweden requires that every course have a sustainability aspect in whatever way (von Oelreich, 2004), this integrated level of sustainability education is the exception not the norm. Even in highly recognized organizations such as in the University of British Columbia, the first Canadian University to have issued a sustainability policy and where the policy states that “the ... goal is to integrate sustainable development into all university activities... by means of a unique blend of research, teaching and practice” in 2004 the university senate has not approved the implementation of a mandatory interdisciplinary course in sustainability studies for all students (Gutz, 2004).

1.2.2.2 Research

Without stating which of the two comes first, and with the view that the answer might vary from institution to institution, beside education, research is the most important function of a University. As some Universities might be entirely oriented toward sustainability and almost all of their research is done in a sustainability context (research can include contracted research for industry, private social partnerships, research institutions within universities that focus on sustainability,...) others make it mandatory that all final theses at least have to include what meaning the thesis has in a sustainability context. Others measure their sustainability performance in a function of the ratio of theses that consider sustainability and the others do not consider sustainability in any specific way. The mandate that universities have in the investigations of the social, economic and environmental context, is important.

1.2.2.3 Outreach

Universities, not only through student education but also directly have influence to the external social system. This can be either in the scope of lifelong learning programs or

community service. The Autonomous University of San Luis Potosi for instance, is very active in the development of outreach activities (i.e. the Agenda Ambiental helps with the development of local Agenda 21 developments, regional planning,...)

Also quite monetarily, the money spent in any way by the Universities support the local and global society. Universities here take the role as employer, contractor and customer among others and thus may have a considerable impact on the larger community. The universities of Cologne for example are the city's third largest employer. Here the environmental and social awareness of employees and the role of sustainability issues in purchases of materials and services may reach out to the larger society. The European Eco Management and Audit Scheme (EMAS) addresses this aspect as an indirect environmental aspect of organizations (European Parliament, 2009).

1.2.2.4 Campus ecology

The impact and interactions universities have with the environment are referred to as campus ecology (i.e. impact of transport of students, employees and staff, energy and water consumption of the buildings, land use, resource conservation, waste, recycling, green purchase, ...). As campus ecology is close to the green grass roots of the sustainability development in universities "Campuses excel in traditional operational measures – such as recycling – but are reluctant to undertake more ambitious operational activities, such as promoting alternative transportation and buying renewable energy" (Shriberg & Tallent, 2003).

As examples and further support of programs targeting Campus Ecology the Harvard University (Sharp, 2002), Swedish Universities (von Oelreich, 2004) (Arvidsson, 2004) the University of British Columbia (Gutz, 2004) the Technical University of Catalonia (Ferrer-Balas, 2004), the Sheffield Hallam University (Downey, 2004) can be listed ...

Environmental Management Systems are often used to coordinate and frame campus ecology initiatives. The direct ecological impact of Universities is moderate. But campus ecology is not limited to the environmental aspect of sustainability. Due to considerable

savings potential (for instance by saving energy, water, ...) it has an impact on the financial sustainability and surely, as the most important factor, it has impact on the sustainability of the social system. The three university subcultures (students, staff and administration) can group around the campus ecology and develop integrated projects. In society there are not many institutions that support sustainability in a larger sense. Universities in this context can serve as role models. Students are likely to consider sustainability, as an artificial construction rather than a functional way of life as long as the educational establishment that teaches them is unable to realize the concept fully. So, campus ecology is in a certain way a precondition.

2 Conceptual Frame

2.1 Environmental Management Systems

2.1.1 The organization and its environments

One of the assumptions in early system theory considerations was the concept of balance and equilibrium - the idea of an installed mechanic or a certain kind of infrastructure that operates towards an equilibrium state. The interest was in the relation of perturbation and equilibrium state stability.

Thermodynamic considerations on closed systems, especially the second thermodynamic law that specifies that in a closed, or from its environment isolated system the disorder increases towards the thermodynamic equilibrium. From a thermodynamic point of view the final equilibrium means a state of evenness as total disorder. This is in sharp contrast to an equilibrium state of order – a state where distinctions can be made and structures can be found. The question was how this observable order could be explained in systems. As a consequence, systems were modified towards the understanding of systems as open systems and not as closed systems as a response to this thermodynamic critique.

At this abstract level of a theory on open systems, the interrelations between the environment of the system and the system are still undefined. The idea that some aspects of

relations of the system and its environment may have a bigger meaning to the system than others is not implicit. It is only stated that the system is located in an environment and there are interrelations and exchange. The interesting question that arises from the concept of open systems is how the interrelation of the system with its environment allows for the generation of order. The answer depends on the type of system that is observed (for biological systems this might be energy and for social systems, information, ...) Ecological questions on dependency of a system from specific interrelations of a system with its environment are addressed by system-to-system interrelations (Simon F. B., 2008) (Luhmann N. , 2009). Referring to ecology, Howard Odum expresses this like:

“An environmental system is a network of component parts and processes on the scale of the environment. Environmental systems usually include some area of the earth’s land or water. Examples are forests, lakes, seas, farms, cities, regions, countries, and the biosphere as a whole. These tend to be comprised of living organisms, chemical cycles, water flows, components of the earth, and so on. The components often include humans and human-manufactured machines, units, or organizations such as industry, cities, economic exchanges, social behavior, and transportation, communication, information processing, politics, and many others. Each of these components is a complex subsystem of the larger environmental systems” (E. Odum in (Remage & Shipp, 2009)).

For the analysis of larger systems’ patterns Odum advocated, in the beginning 1970’s, a macroscopic view.

“Bit by bit the machinery of the macroscope is evolving in various sciences and in the philosophical attitudes of students. ... Whereas men used to search among the parts to find mechanistic explanations, the macroscopic view is the reverse. Men, already having a clear view of the parts in their fantastically complex detail, must somehow get away, rise above, step back, group parts, simplify concepts, interpose frosted glass, and thus somehow see the big patterns” (Remage & Shipp, 2009).

Systemic thinking that evolved in different scientific areas such as Cybernetics, System Theory, Communication Theory, Chaos Theory, Complexity Theory, etc. share the idea of replacing linear cause and effect schemes with non-linear, cybernetic explanations, shifting interest from the observation of isolated objects towards the interrelations between them. Thus, the whole is not only more than the sum of its parts in a quantitative way but also that the emergent properties that appear can be qualitatively different (Simon F. B., 2008).

2.1.1.1 The organizations environmental performance as system-to-system relation

In this subchapter we will leave the general level and analyze the relation of the organizational system with the systems in its environments. For the analysis we will focus on the relation of the organizational system to the physical, social and individual environment (Figure 2). We will contrast concepts of environmental management systems with system theoretic positions.

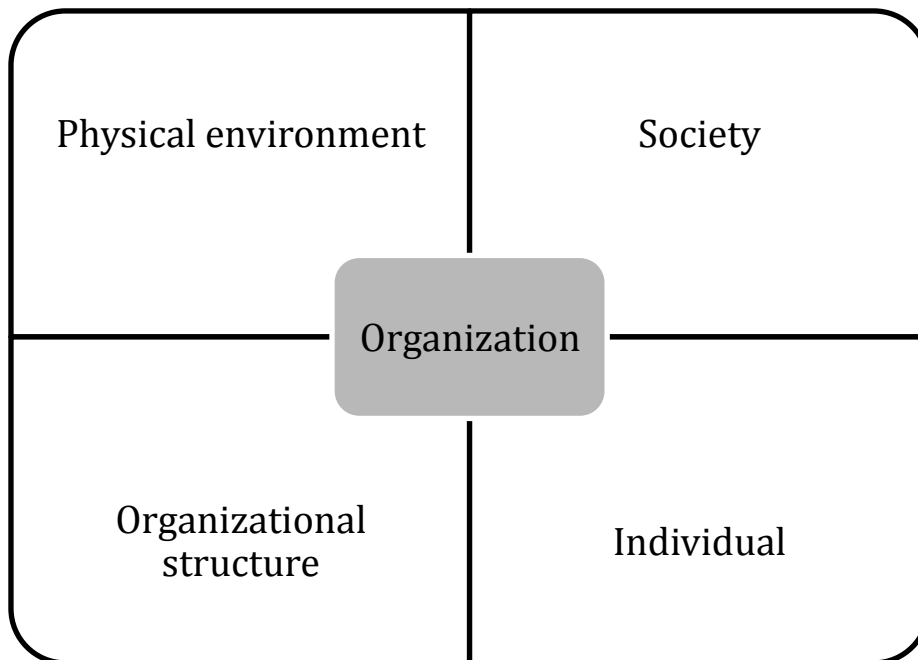


Figure 2: The organization and its environments (own elaboration)

Input and output models or better, input – operation – output models assess the question of the interrelation of a system with other systems. In an organizational setting (where an organization is defined as the system), this aspect of an input – operation - output model is

that of achieving desired outputs from a set of inputs a system requires from other systems. Thus, the environmental performance of an organizational system in the input–operation–output model is the combination of inputs in the process of operation that generate certain desired outputs such as products and others that are not desired, such as waste. In this way, the input–operation–output model is the underlying concept for the assessment of the environmental performance of an organization (Franke, 2001). Environmental management systems aim to improve the environmental performance of an organization. In the Eco Management and Audit Scheme – or EMAS - the environmental performance is defined as “... the result of an organizations management of its environmental aspects” (European Parliament, 2009). In the following paragraphs we will review the process how environmental management systems like ISO and EMAS address these input – operation – output relations.

The target unit for the assessment is the site, which is defined as – “a distinct geographic location under the management control of an organization covering activities, products and services, including all infrastructure equipment and materials” The EMAS scheme is explicitly local in its focus. Not only can whole organizations be certified but also parts of an organization as long as they have their own functions and administrations and as a result of this able to implement and maintain an environmental management system (Strauß, 2005) (European Parliament, 2009).

While in ISO 14000 an initial assessment of the organization is optional in EMAS it is the mandatory starting point. This assessment typically starts with an analysis of the operations, products and services an organization has. It is common to start the analysis with a spreadsheet detailing the organizational operating areas in a sufficiently high abstraction level and associate environmental aspects within the organizational operating areas. (Strauß, 2005) (Savely, Carson, & Delcos, 2006) For these activities, we follow the assumptions of a black box model. This model abstracts from the internal organization and limits the analysis to the interaction and interrelations of the organization with its environment. This assessment results in a list of organizational activities.

Starting from this list, the environmental aspects related with the activity and the environmental impact are assessed. Environmental aspects are defined as “an element of an organization’s activities, products or services that has or can have an impact on the environment” (European Parliament, 2009) whereas an environmental impact is defined in a value neutrally as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s activities, products or services” (European Parliament, 2009).

Following the list of activities, the organization has to address direct and indirect environmental aspects. The direct environmental aspects are associated with the activities, products and services of the organization itself. In order to be considered a direct environmental aspect, the organization has to have direct management control over these environmental aspects. These activities normally are produced directly by the organization and its installations (European Parliament, 2009). EMAS Annex I provides, but not limits direct environmental aspects as follows (European Parliament, 2009):

- (a) Legal requirements and permit limits
- (b) emissions to air;
- (c) releases to water;
- (d) production, recycling, reuse, transportation and disposal of solid and other wastes, particularly hazardous wastes;
- (e) use and contamination of land;
- (f) use of natural resources and raw materials (including energy);
- (g) local issues (noise, vibration, odor, dust, visual appearance, etc.);
- (h) transport issues (both for goods and services)
- (i) risks of environmental accidents and impacts arising, or likely to arise, as consequences of incidents, accidents and potential emergency situations;
- (j) effects on biodiversity

The indirect environmental aspects are not under direct management control of the organization. They result from the interaction of the organization with other parties. In

order to represent an indirect environmental aspect, the organization must have a reasonable degree of influence over this aspect (European Parliament, 2009). This means that the organization has an influence on the third parties that directly control the environmental aspect.

It is explicitly stated in EMAS that for non-industrial organizations the assessment of the operational environmental aspects is not sufficient. They are also required to include environmental aspects related to their core business (i.e. insurance companies and what they insure, ...). As a non-exclusive list on indirect environmental aspects the EMAS provides (European Parliament, 2009):

- (a) product life cycle related issues (design, development, packaging, transportation, use and waste recovery/disposal);
- (b) capital investments, granting loans and insurance services
- (c) new markets;
- (d) choice and composition of services (e.g. transport or the catering trade);
- (e) administrative and planning decisions;
- (f) product range compositions;
- (g) the environmental performance and practices of contractors, subcontractors and suppliers.

For institutions of higher education the considerations of indirect environmental aspects are related to the influence on the social external environment. Research findings, education and outreach are the indirect environmental aspects for these institutions as the universities' relation towards institutions, the economy, and society can be indirectly influenced by the outcomes of these three organizational products. EMAS puts special attention to the procurement procedures on behalf of indirect administrative environmental aspects and states explicitly that organizations must be able to demonstrate that the significant environmental impact of the procurement procedure is addressed (European Parliament, 2009).

Not all environmental aspects of an organization have the same degree of importance. Organizations have to establish criteria for the assessment of the significance of the direct and indirect environmental aspects. The significance of the environmental aspect is related to the significance of the environmental impact. The criteria for the assessment of the significance is established by the organization itself. However, EMAS requires the individually established criteria to take into account the legislation of the European Community, be comprehensive, capable of independent checking and that they be reproducible. Furthermore, the criteria established for evaluation of significance have to be available publicly (European Parliament, 2009). As guidance for the development of the criteria, EMAS provides the following non-exclusive list (European Parliament, 2009):

- (a) information about the condition of the environment to identify activities, products and services of the organization that may have an environmental impact;
- (b) the organizations' existing data on material and energy inputs, discharges, wastes and emissions in terms of risk;
- (c) views of interested parties;
- (d) environmental activities of the organization that are regulated;
- (e) procurement activities
- (f) design, development, manufacturing, distribution, servicing, use, re-use, recycling and disposal of the organizations' products;
- (g) those activities of the organization with the most significant environmental costs, and environmental benefits

For the significance of an individual environmental aspect the following criteria are mentioned (European Parliament, 2009):

- (a) potential to cause environmental harm
- (b) fragility of the local, regional or global environment
- (c) size, number, frequency and reversibility of the aspect or impact
- (d) existence and requirements of relevant environmental legislation
- (e) importance to the stakeholders and employees of the organization

Typically, an environmental balance of the organization is established in order to assess the direct environmental aspects. Starting from the activity list, the energy and matter flows of the organization in environmental accounts are established and the flows are measured and later assessed according to their significance (Strauß, 2005).

The organizational system is in operation in every instance of its existence. It constantly pulls resources (Simon, 2008) (Simon, 2007) as inputs from the outside of the organizational system environment, e.g. people as workforce, energy, water, etc., into the system where it operates and transforms them into outputs. These normal operational conditions are not sufficient for the assessment of the systems interrelations; emergency conditions and special conditions in the start up and shutdown conditions should also be considered (European Parliament, 2009). Furthermore, for the assessment, time considerations are requested – past, present and planned activities in the future should be included (European Parliament, 2009). In these time and memory considerations the assessment of the existing environmental procedures and the results of previous accidents also have to be analyzed.

The reporting structure that emerges from the assessment of the significant direct and indirect environmental aspects requires a minimum content. EMAS requires organizations to report at least on core indicators.

2.1.1.1.1 Core Indicators

EMAS explicitly states the need to report on specific indicators that are binding to all organizations. These core indicators have to be included into the environmental statement and the environmental performance report, and as such, into the external communication. The key indicators focus on the performance in (European Parliament, 2009):

- Energy efficiency
- Material efficiency
- Water

- Waste
- Biodiversity
- and Emissions

In these areas the standard also indicates how these measurements have to be measured and visualized. This is binding for all organizations. Organizations have to report, in a first figure, the total input/impact in a given field. They have to report (European Parliament, 2009):

- (1) on Energy efficiency concerning the *"total direct energy use"* shall indicate the total annual energy consumption, expressed in Tons of oil equivalent (toe);

concerning the *"total renewable energy use"* shall indicate the total annual energy (electricity and heat) consumption produced from Renewable Energy Sources, expressed in Tons of oil equivalent (toe)

- (2) on Material efficiency concerning the *"annual mass-flow of different materials used"* (excluding energy carriers and water), expressed in Tons.
- (3) on Water concerning the *"total annual water consumption"*, expressed in m³.
- (4) on Waste concerning the *"total annual generation of waste"*, expressed in Tons
- (5) on Biodiversity concerning the *"use of land"*, expressed in m²
- (6) on Emissions concerning the *"total annual emission of greenhouse gases"*, expressed in Tons of CO₂ equivalent.

In a second figure organizations have to indicate the overall annual output of the organization. This “is the same for all fields, but is adapted to the different types of organizations, depending on their type of activity. In particular, it distinguishes between organizations working in the production sector (industry), where it shall indicate the total annual gross value- added expressed in Million € (Mio€) or, in the case of small organizations the total annual turnover or number of employees and organizations in the

non-production sectors (administration/services), where it shall relate to the size of the organization expressed in number of employees” (European Parliament, 2009).

In a third figure they are required to put the input/impact data in relation to the output figure (European Parliament, 2009).

2.1.1.1.2 Other relevant indicators:

Apart from these general environmental performance indicators, organizations are also required to report on specific environmental aspects. The indicators chosen must (European Parliament, 2009):

- (1) give an accurate appraisal of the organizations performance;
- (2) are understandable and unambiguous;
- (3) allow for a year on year comparison to assess the development of the environmental performance of the organization;
- (4) allow for comparison with sector, national or regional benchmarks as appropriate;
- (5) allow for comparison with regulatory requirements

2.1.1.2 *Organizational System and organizational structure*

When we have a look to the organizational system we change our perspective. From the simplification of a black box or input–operation–output assumption we will now focus on the content of the black box. We focus on the question of what is going on in the inside of the organization. We change from a perspective of a system-to-system relationship towards the organizational system.

When we talk about organizational structure we think about organizational charts and horizontal and vertical integration. These considerations are based in classical text and founders of organization and management sciences from the beginning of the last century. Considerations of Max Weber about legal authority (traditional authority and charismatic authority) come to mind. Organizational Authority is supported by an administrative

organization that follows detailed procedure directives and is independent from people occupying the positions of the organization. The formal competence of a position is composed of a defined scope of command. The organization is built by a hierarchy where every position has a superior and is embedded in a line of instances (unity of command). The position is governed by a set of rules that apply in a general way, are relatively abstract, stable over time, complete and can be learned by the holder of a position. The bureaucracy is characterized by defined competences (we can refer to this as vertical competences) and tasks (we can refer to this as horizontal specialization). The communication between different positions is formal (files). Frederic Taylor further developed the horizontal and vertical specialization. He analyzed the work tasks in detail and the resulting positions in the organization were responsible only for especially low sets of tasks or movements. He also advocated the strict separation of office and manual work and through this, increased vertical specialization. Not only in the operative, but also in the dispositive organizational level he introduced horizontal specialization. This resulted in a multiple line system where positions reported to different superior positions (these principles are still discussed in organizational science areas such as matrix structure, project and team organization). Fayol included considerations that every organization shows six overarching functions, (i.e. technical function, commercial function, financial function, accounting function, security function, administrative function) these functions are represented in each organizational position but to a different degree. By this, Fayol increases the aspect of function or requisites the person position shows. The requisites of the positions shift from operational skills of lower hierarchical positions towards increased administrative skills in higher hierarchical positions. Fayol also advocates the principle of unity of command and a single-line organization where he introduces considerations of how many subordinate positions should be controlled by a hierarchically superior position (span of control). He sees that the advantage of order of this form or organization has the disadvantage of slow information processing. To compensate this, Fayol proposes a line and staff organization (Wolf, 2008).

This classic understanding where organizational structure is determined through the distribution of authority, competences, responsibilities, and the attribution to certain

positions opens on one side the idea of design or designability. Organizational structure in this classic understanding is rooted in rationality. The environmental management standards are relatively unspecific but follow implicitly the classic assumptions of organization theory.

Within the EMAS, standard organization “means a company, corporation, firm, enterprise, authority or institution, located inside or outside the Community, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administrations“ (European Parliament, 2009).

Within the organizational system special importance is given to the role of the top management. Top management in the EMAS is responsible for (European Parliament, 2009) (Strauß, 2005):

- 1) Sufficient funding of the environmental management system. Sufficient means that it is possible to improve maintain and implement the environmental management system. Resources in this sense include financial, technical, and human resources as well as organizational infrastructure
- 2) Definition of the environmental policy of the organization
- 3) Defining a management representative responsible for compliance of the organization with the regulation and reporting on environmental performance
- 4) Reviewing the organizations environmental management system for compliance, communications from the interested parties, target deviance, status of corrective action and prevention, follow up on questions from previous reviews, changing circumstances, recommendations on improvements.
- 5) Accepting the environmental program
- 6) Accepting environmental management handbook
- 7) Releasing an environmental statement

It is, however, of importance to think about the concept of organizations - as it is within these organizational systems where environmental management systems aim to improve the

environmental performance. In the following paragraphs we will analyze the organization from a system theoretic point of view. As the theoretical framework of systems theory is extensive and consists of unusual assumptions compared to classic organizational thinking we have to clarify certain aspects of this theory.

A system, according to Luhmann, “is the difference of the system and the environment (Luhmann N. , 2009). If the system is a difference, we should specify what this difference or distinction is. In order to assess this difference, system theoretic scholars often use a calculus of Spencer Brown (Luhmann N. , 2006) (Luhmann N. , 2009) (Simon F. B., 2008) (Simon, 2007) (von Foerster, 2008). In the Spencer Brown calculus a distinction is composed of two elements – a distinction and an indication. Spencer Brown uses a symbol, which he calls cross to visualize the distinction - where he uses a vertical line that expresses the distinction and a horizontal line that represents the indication. “Draw a distinction and a universe comes into being” means a two step process. First, make a distinction and then indicate on which side of the distinction you are. The universe, which comes into existence when a distinction is drawn, is indicated inside of the distinction and the exterior side is everything else – the rest of the universe. For system theoretic consideration this is the distinction of the system and the environment. The indication is on the side of the system leaving everything else as the environment. With this the system is characterized as being a form with two sides or the difference of the system and the environment. The Spencer Brown calculus is limited to one operation, a distinction that is composed of the distinction and the indication. For system theoretic considerations, it is now interesting to think if it would also be possible to limit the operation of a system to only one operation.

For social systems Luhmann (Luhmann N. , 2009) proposes to limit the operation of social systems to one single operation – communication. A communication is not understood as an act of a person but it is seen as an event. (Whereas the event is composed of three parts: message, information, and understanding. It is important in this context to see that a communicative event is not a technical transmission of information but requires the interpretation of the observer for the building of understanding. The need of observation

and interpretation introduces the theoretic body of constructivism to systems theory (Simon, 2007)).

It is hard to think of a single communication as a system. For being a system the communication has to exist for a longer period of time. One communicational event has to connect with another communicational event. Furthermore, the system in a thermodynamical sense needs to build a certain aspect of order that is different from general entropy.

The type of operation depends on the kind of system. In chemical, physical or social systems this might be very different. The question that arises is, if it is also possible to limit a system to only one operation for organizational systems. What single operation could create a before and after difference to the operation? What operation can connect with another operation? Luhmann (Luhmann N. , 2006) proposes the decision as the basal operation for organizational systems.

When one type of operation starts and is able to connect with the same type of operation, a system is generated. Here, the connection means that it has consequences for the following operation. The operation needs to be able to control its ability to connect to the same type of operation. Through this connection the operation generates a form – a difference, an inside and an outside. It needs to be able to draw a distinction, indicating the inside, that is able to connect and an outside that expresses everything else that is not connectable. By this, when one operation connects with, and limits another operation to operate inside of the form, a system is generated. Following Maturana (Maturana, 2008), this concept, when a system produces itself from its own operation, is called autopoiesis. A social system evolves when communication connects with another communication. Or, in the case of organizational systems, when one decision has connectivity with past decisions and limits future decisions.

If the operation controls its own connectivity it has to be in a certain way self-referential. The distinction, which is composed by the distinction of distinction and

indication, has to observe what is inside of the distinction. In the case of a social system, whose operation is communication, the self-reference is expressed by the message and the external reference, by information (Luhmann N. , 2009). For a better understanding, the self-reference can be understood as the connectable themes of a communication – the external reference as information.

For an organizational system, decisions are not determined by previous decisions. The autopoiesis demands connectivity whereas a decision requires uncertainty (if not, the decision would not be necessary). The self-reference of the system controls connectivity with previous decisions whereas the reference to the exterior produces the representation of the exterior within the system. The term re-entry refers to the concept that through the oscillation between self-reference and external reference the distinction is copied into the system. A decision refers to past decisions and to the external reference that guaranties uncertainty.

When a system is created by an operation that connects with another operation and so generating an inside, the operation can only operate inside of the system. It is impossible to operate outside of the system as the very system itself is generated by the operation. If the system is the difference of the system and the environment, it is impossible to operate on the outside – this would jeopardize the difference. This means the system is operationally closed – it can only operate inside the system although it can refer to the outside. The outside therefore, can only be seen as a representation in a constructivist sense.

That systems are operationally closed implies that they can only operate with their own operations. There is nothing else for the system other than its own operations. As a consequence the structure of an operationally closed system has to be built by the operations of the system and as such within the system. Structure cannot be imported into the system. The concept of structural determinacy is that irritations from the outside can only be treated by the structure that exists in the system. But the implications of structural determinacy go further. It limits causal connection of irritation from the environment and the reaction of the system. As the organizational operation creates the structure of the

system, the system can modify its structure through internal operations (i.e. it can learn). The same kind of irritation can lead the system to respond differently (Simon, 2007).

Out of this follows that the response is dependent of the internal state of the system. This concept is also developed in cybernetics. Heinz von Förster makes a distinction of trivial machines where a certain irritation of the machine leads to a certain output. Non-trivial machines are machines that refer to their actual state and lead to different results depending on their actual state. Social systems and organizational systems can be understood as non-trivial machines (Luhmann N. , 2009).

Decisions, to be decidable, require uncertainty. In the case of absence of uncertainty, there would not be the necessity for decision. Furthermore, a decision requires an alternative. We need to be able to decide between different choices. In terms of Gergory Bateson (Luhmann N. , 2006) we further need information, as a difference that makes a difference and that leads to a choice between the alternatives. This again is a construction of a form – the choice and everything else. In the moment of a decision where the alternatives are present we have an accumulation of uncertainty. After the decision, this uncertainty is replaced by certainty. The connection of decisions with decisions is the way an organization reduces uncertainty to certainty and at the same time reproduces uncertainty for further decisions (or we could say decisions call for further decisions).

Along with the input – operation – output model comes the notion of an ongoing process - the constant transformation of inputs into outputs through operation. A university constantly transforms students to graduates. This transformation process, or this operation, is maintained even when professors change, are on sick leave or when they are on sabbatical. How can the consistency of coordinated operation be explained even when the organizational composition changes?

Luhmann (Luhmann N. , 2006) explains organizational structure with the help of decision premises. Decision premises are decisions that limit the possibilities of a number of future decisions. Structure, by this, is the product of operation and through operation

(here decisions) the structure is reproduced or changed. Decision premises may take the form of rules, conditional or mean oriented programs, persons, positions, ...

This gives the organization an inherently complex understanding. It constantly operates and reproduces itself. The organizational system is constantly confronted with uncertainty. It absorbs and reproduces uncertainty. It reduces complexity and rebuilds complexity. The understanding of organizations in EMAS is different. It replaces the complexity of organization with a traditional and normative position.

EMAS focuses on the organizational structure mainly in connection with the formal responsibilities for environmental targets within the environmental program. It requires defining, documenting and communicating these roles and responsibilities at the relevant functions and levels of an organization. Further EMAS requires an established procedure for internal communication among the various levels and functions of the organization.

The underlying assumption in EMAS and ISO standard relies on a notion of rationality. The responsibility for the environmental management system is located at the top of the organization. The top management secures resources. Then the responsibilities are delegated and periodically reviewed. Complexity issues are not addressed.

2.1.1.3 Relation to the Social System

EMAS addresses the embeddedness of organizations into a larger social system in a sense of information exchange. When we see organizational systems as systems, where the communication of decisions connects with other decisions and social systems emerge when communications connect with communications; how the organizational system communicates with the social systems surely is an interesting analysis for system theoretic considerations. However, as this thesis puts its focus on the organizational system we will limit the analysis to the requirements of ISO and EMAS for this interrelation.

ISO 14000 standards require the organization "... shall decide whether to communicate externally about its significant environmental aspects, and shall document its decision. If

the decision is to communicate, the organization shall establish and implement a method(s) for this external communication”(European Parliament, 2009). EMAS requirements for information related to the external social system are more comprehensive. EMAS standard requires organizations to be able to demonstrate an open dialogue with the public and other interested parties. EMAS explicitly demands the inclusion of the local communities and their customers in the assessment of the environmental impact of their activities, products and services. Organizations are required to identify the concerns from the public and other related parties relating to these aspects (European Parliament, 2009).

EMAS requires organizations to build confidence with the interested parties. The provision of environmental information is considered a key factor of differentiation of the European Eco Management and Audit Scheme in comparison to other standards. The provision of information should be marked by openness and transparency, and is to be provided on a periodic basis. Organizations are free to direct environmental information (or parts of it) towards specific audiences as long as the complete information is available to the public upon request. Specifically, organizations are required to demonstrate “... that anybody interested in the organizations’ environmental performance can easily and freely be given access to the information” (European Parliament, 2009) that comprise the Environmental statement and the core indicators.

Although the EMAS standard allows organizations to present information in an aggregated company wide structure that comprises different areas and geographic locations, the principle of local reporting must be met. The organization must ensure that the site-specific environmental aspects of each location can be clearly identified within the report (European Parliament, 2009).

Both ISO and EMAS standards require the organization to have procedures in place and maintained which will structure the communication in order to “ensure communication among various levels and functions of the organization” (European Parliament, 2009) and for “receiving, documenting and responding to relevant communication from external interested parties” (European Parliament, 2009).

2.1.1.4 Individuals

“Everyone of us is a system, that is composed of subsystems, that on their own are composed by other, smaller subsystems. Small cells are organized to organs like the stomach, the heart and the brain. These organs form a system that makes possible the digestion, blood circulation and information processing. Also, these systems compose a system like the individual – that is on its own; part of a family, a culture, or a social system. Everyone of us is a biopsychosocial system. In order to understand human behavior, we must analyze how these biological, psychological, and sociocultural systems work and interact” (Myer, 2008).

First, in this subchapter we want to develop thoughts on the interrelation of biopsychological systems with organizational systems, and secondly we will describe the interrelation as it is seen in ISO and EMAS.

As we have seen above – if derived from thermodynamically considerations, open systems require an environment to maintain order and if organizational systems are defined as the difference between the system and its environment; the question of the relation between the system and its environment has to be answered. The concept of structural coupling, like the concept of autopoiesis (referring to Maturana) explores this question. While autopoiesis is directed to the reproduction of the system by its own operations, structural coupling explores the question of how the interrelation of the system with its environment is coordinated. For Maturana, for a system to survive autopoiesis is required. But, what structures the system develops and with what structures the system couples to its environment is another question – as long as the structural coupling is compatible with the autopoietic reproduction. Structural coupling is also a kind of form. On the inside there are the structures that have reference to the aspects of the environment and everything else is not coupled with the system. The environment on the outside of the form still can have causal effects on the system but only in a destructive way. By limiting the system coupling to the environment to only a certain amount of aspects the system is not irritated and doesn't have to react to everything within its environment. Only if the system can limit its irritations from the exterior to a computable level can it process, react, or start structural

adoptions. The reduction of complexity permits the building of complexity within the system (Luhmann N. , 2009).

Newer system theoretic considerations see organic, psychological, social and organizational systems as operationally closed but structurally coupled systems (Luhmann N. , 2006). Social as communicative systems can hardly be imagined without psychological systems. Although the communicative system cannot enter the psychological system and the psychological system cannot operate outside the brain they both require each other in every instance. These systems are structurally coupled.

If we understand the organization as a special kind of social system, the individual is located in the exterior of the social system - but structurally coupled with the organizational system. However, for the social system only the person is of concern. It is impossible to know what is going on in the individual in all its inner biopsychological complexity – but through communication the individual is generalized in the form of a person with certain characteristics that are treated by the social system as stable. That an organizational system does not have direct control over the structurally coupled systems might complicate the relation of organizations and the individuals. The organization might be required to address this complication – it certainly has to address the relation of the organization and the individual.

The ISO 14000 standard family is straight forward on how to target the individual within the environmental management system. It focuses mainly on the educational aspect of the individual. The organization, as the social system, has to “ensure that any person(s) performing tasks for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organization is (are) competent on the basis of appropriate education, training or experience,...” (European Parliament, 2009). As the organization has to ensure that individuals are trained it has the obligation to establish and identify the training needs in accordance to the environmental aspects identified. The individuals shall know the importance of being aligned with the environmental policy and its procedures and requirements, the significant environmental aspects that are associated

with their work and the improvements that can be achieved through their personal behavior, their specific role for achieving the conformity with the environmental management system requirements, and finally the potential consequences if they do not adhere to the specified procedures.

EMAS increases the importance of the inclusion of the individual level from the educational towards a participatory focus. Not only do people have to be educated for compliance but EMAS requires active participation. The individual employee is seen as being the key resource for improving the environmental management system. Active employee participation is considered a prerequisite and driving force in the improvement process. Even more, employee participation is seen as a feedback process between the individual and management; to achieve improvements, responsiveness, and active individuals, support from the management is eminent for success (European Parliament, 2009).

EMAS explicitly requires employee participation in the process of continuous improvements in the environmental performance in (European Parliament, 2009):

- (a) the initial environmental review, the analysis of the status quo and in collecting and verifying information,
- (b) the establishment and implementation of an environmental management and audit system improving environmental performance,
- (c) environmental committees to gather information and to ensure the participation of environmental officer/management representatives and employees and their representatives,
- (d) joint working groups for the environmental action program and environmental auditing,
- (e) the elaboration of the environmental statements.

Organizations need to have adequate forms of participation in place, such as suggestion-systems, environmental committees or project based work groups (European Parliament, 2009).

2.1.2 Continuous Improvement

From the analysis of the interrelation of the different systems we will now give credit to the procedural approach of EMAS and ISO. The cornerstone of environmental management systems is a commitment to continuous improvement. Here the standards put focus on the processes of the organization. On one hand the processes of the organization are the targets of improvement and on the other, continuous improvement on its own can be seen as a process. In the following subchapters we will look at the continuous improvement cycle: from the environmental policy to the environmental program, the integration into operation of the environmental program, audit activities and performance reports.

2.1.2.1 Vision and organizational environmental policy

As an outcome of the environmental review process an environmental review report is issued. The environmental review report gives a summery of the executed environmental review and gives an overview of its outcomes in a compact form. It represents the actual state of the organization and the actual environmental performance. The report comprises a summery of the requirements of the environmental review, like environmental aspects, legal compliance, the existing environmental organization and outcomes of previous incidents. Moreover, the environmental review report gives evidence of the executed environmental review and is of help for the external auditor. It serves also as an information tool for the top management (Strauß, 2005).

The outcomes of the environmental review along with this the environmental review report, are the basis for the development of the environmental policy. The formal requirements for the environmental policy require (Strauß, 2005) (European Parliament, 2009):

- 1) To be appropriate to the nature, scale and environmental impacts of its activities, products and services

- 2) A commitment to continual improvement and prevention of pollution
- 3) A commitment to comply with applicable legal requirements and with other requirements to which the organization subscribes which relate to its environmental aspects
- 4) Provision of the framework for setting and reviewing environmental objectives and targets
- 5) To be documented, implemented and maintained
- 6) To be communicated to all persons working for or on behalf of the organization;
- 7) To be available to the public
- 8) To be included in the environmental statement
- 9) To be audited by an external auditor

Besides this technical aspect that is developed through this logic of analysis and policy development, we would like to see the environmental management policy as a kind of organizational vision.

Organizing the organization is understood as planning in order to reach the purpose the organization was created for (Karl Weick in (Simon, 2007)). Universities for example, are created to satisfy the needs for education, research and outreach. This consideration is connected with a machine model. But an organization means different things to different interested parties. An industrial organization, for example, has significance for the state as a source of taxes, for the employees it means work and with this subsistence or a possibility to create personal satisfaction, for the owners it means rents, etc. There coexists a wide range of organizational rationalities. An organization serves the interested parties to different ends. The interest that most parties share is the ongoing autopoiesis of the organization – its survival (Simon, 2007).

The vision of an organization is a projection of the organization of how it wants to be in the future. The common practice of a leadership team that takes a few days retreat, groups around the problems of the organization and after this process, announces the new vision of the organization does not reflect the target ambiguity of its interested parties. With this

practice the vision is imposed on the organization from the top. It is common that the vision developed by the management team also monopolizes validity. The development of a shared vision is one of Peter Senge's (Senge, 2006) five disciplines that a learning organization requires. He understands a vision not as a picture of the future but more like a hologram that has different aspects dependent from which angle it is seen. The pluralistic views of the interested parties should be aligned in order to create a common picture of the future that may have a different aspect depending on the angle from which it is analyzed. This is close to the distinction of internal and external motivation (Myer, 2008) and the concept of affective commitment (two other forms of commitment are normative commitment and continuous commitment (Greenberg & Baron, 2008)).

The development of an environmental vision in organizations such as universities might be especially challenging. In their garbage can model Cohen, March and Olsen characterize universities as organized anarchies where "the organization operates on the basis of a variety of inconsistent and ill defined preferences" (Cohen, March, & Olsen, 1972). Thus, allowing a hologram vision to emerge could be promising.

A vision, as at the University of British Columbia in the faculty of agriculture where "as sustainability means many things to many people – to us it essentially means trying to balance ecology, economy and community to provide for a positive future" (Gutz, 2004) comes closer to a hologram than "ensuring that sustainability stands on three legs" as at the University of Florida (Newport & Lindner, 2003).

2.1.2.2 Environmental Program

Directly derived from the environmental policy, as highest level, the overall goals of the organization and the environmental objectives of the organization have to be established. These environmental objectives should be quantified if practicable (European Parliament, 2009). From this, in the next lower level, detailed and quantified performance requirements have to be established. These environmental targets need to be set and met in order to achieve the higher arching environmental objectives and by this comply and be aligned with environmental policy (European Parliament, 2009). The sum of the individual

environmental objectives and targets, which comprise a description of the measures, the responsibilities, the means to achieve the targets, and the deadline when the targets should be reached, build the environmental program of the organization (European Parliament, 2009).

2.1.2.3 Integration into operation

The activities that are identified as relevant in their environmental aspects and are of importance for the environmental performance or the organization has to be reorganized in order to address the environmental aspects. If there are already organizational procedures existing, for example toxic waste treatments and so on, these existing procedures need to be expanded by the relevant environmental aspects. If relevant procedures for an identified activity do not exist they have to be created. EMAS and ISO requirements are specific on this point. The procedures always have to be documented and maintained when the absence of a procedure could lead to a deviation from the specific targets, the objectives or the environmental policy. In the procedures the operating criteria has got to be included. The operational procedures are not limited to internal operations but also require that suppliers and contractors to know the applicable procedures and requirements (European Parliament, 2009).

The development of the environmental program and its conversion to operation is a core activity in the transformational process. Classic project management asks the question of who is doing what, until when, and in which amount. It breaks down the over all target into sub targets and assigns the means accordingly.

2.1.2.4 Audit System

The audit system of ISO and EAMS standards ensures the compliance of the organization with its applicable legal obligations and the compliance with the standard family requirements and by that the continuous improvement of the environmental performance (European Parliament, 2009).

2.1.2.4.1 Audit Program and Audit Frequency

The audit program aims to gather data on the organizations environmental performance and effectiveness of the environmental management system. This data is converted into information for the management of the organization in order to provide the actual status of the organization (European Parliament, 2009).

The audit program shall guarantee that the management of the organization is provided with the information it needs to review the organizations' environmental performance and the effectiveness of the environmental management system and, be able to demonstrate that they are under control. The objectives of the audit program addresses the implemented management system for compliance to the policy, objectives, targets deduction and the regulatory requirements (European Parliament, 2009).

The audit program is composed of several individual audits. For the assessment of the scope of each individual audit, the area that will be covered needs to be specified and defined - e.g. the activities that will be audited, the environmental criteria that will be considered and the period covered by the audit. The factual data that is necessary to evaluate the performance is included within the scope of the audit (European Parliament, 2009).

The individual audits are those that are executed as internal audits, where internal environmental audit means “a systematic, documented, periodic and objective evaluation of the performance of the organization, management system and processes designed to protect the environment” (European Parliament, 2009). The auditors can be individuals from within the organization that have the capacity to execute the audit and are sufficiently independent.

An audit cycle has a duration of not more than three years. This means each individual audit has to be performed at least every 3 years and audits have to be executed at least once a year in order to present information of the actual compliance. The frequency of audits depends on the importance of the environmental aspect covered. Depending on the (European Parliament, 2009):

- (a) nature, scale and complexity of the activities;
- (b) significance of associated environmental impacts;
- (c) importance and urgency of the problems detected by previous audits;
- (d) history of environmental problems

The underlying rule is that the more significant the activity is in terms of environmental impact the more often the activity should be audited.

2.1.2.4.2 Audit activities

The activities that have to be carried out in an audit are also detailed in the EMAS standard:

“Audit activities shall include discussions with personnel, inspection of operating conditions and equipment and reviewing of records, written procedures and other relevant documentation, with the objective of evaluating the environmental performance of the activity being audited to determine whether it meets the applicable standards, regulations or objectives and targets set and whether the system in place to manage environmental responsibilities is effective and appropriate. Inter alia, spot-checking of compliance with these criteria should be used to determine the effectiveness of the entire management system” (European Parliament, 2009).

The following steps, in particular, shall be included in the audit process:

- (a) Understanding of the management systems
- (b) Assessing the strengths and weaknesses of the management systems
- (c) Gathering relevant evidence
- (d) Evaluating audit findings
- (e) Preparing audit conclusions
- (f) Reporting audit findings and conclusions

2.1.2.4.3 Reporting Audit findings and conclusions – management review:

At the end of an audit a written report is issued in order to document the scope of the audit, to generate information from the gathered data about the compliance and progress of the organization with regards to its policy, objectives and targets. The report gives information to the management about the effectiveness of its monitoring efforts. Furthermore, the report includes the need for corrective action if deviations are detected in the audit (European Parliament, 2009).

The management is requested to review the organizations environmental management system at planned intervals in order to assess its suitability, adequacy and effectiveness. As internal audits have to be executed once a year and also the environmental statement has to be updated once a year, it is also common practice to execute the management review once a year as most information requested in the management review can be gathered out of these sources (Strauß, 2005).

Out of the environmental audit report the following requested records for the management review can be obtained:

- results of internal audits and evaluations of compliance with legal requirements and with other requirements to which the organization subscribes;

Out of the environmental statement the following requested records for the management review can be obtained:

- the environmental performance of the organization;
- the extent to which objectives and targets have been met;

The following information has to be included separately:

- communication(s) from external interested parties, including complaints;

- status of corrective and preventive actions;
- follow-up actions from previous management reviews;
- changing circumstances, including developments in legal and other requirements related to its environmental aspects; and
- recommendations for improvement.

2.1.2.5 Environmental statement and environmental performance report

The environmental statement is an important tool for interaction with the public and external stakeholders. The stakeholders may include, local citizens, economic associations, agencies, suppliers, customers, institutions or the media (Strauß, 2005) (European Parliament, 2009). As the information is meant to open dialogue it is natural that the standard requires the the information to be presented in an easily understandable and unambiguous manner. Environmental information shall be presented in a clear and coherent manner in electronic form or in printed form. The environmental statement has to contain at least (European Parliament, 2009):

- (a) a clear and unambiguous description of the organization registering under EMAS and a summary of its activities, products and services and its relationship to any parent organizations as appropriate;
- (b) the environmental policy and a brief description of the environmental management system of the organization;
- (c) a description of all the significant direct and indirect environmental aspects which result in significant environmental impacts of the organization and an explanation of the nature of the impacts as related to these aspects
- (d) a description of the environmental objectives and targets in relation to the significant environmental aspects and impacts;
- (e) a summary of the data available on the performance of the organization against its environmental objectives and targets with respect to its significant environmental impacts. Reporting shall be on the core indicators and on other relevant existing environmental performance indicators ,....

- (f) other factors regarding environmental performance including performance against legal provisions with respect to their significant environmental impacts;
- (g) a description of the applicable legal requirements relating to the environment and evidence of compliance with these requirements;
- (h) the name and accreditation number of the environmental verifier and the date of validation.

The environmental performance report shall contain at least these elements and shall meet the minimum requirements as set out below:

- (a) a summary of the data available on the performance of the organization against its environmental objectives and targets with respect to its significant environmental impacts. Reporting shall be on the core indicators and on other relevant existing environmental performance indicators as set out under section D.
- (b) other factors regarding environmental performance including performance against legal provisions with respect to their significant environmental impacts;
- (c) a description of the applicable legal requirements relating to the environment and evidence of compliance with these requirements;
- (d) the name and accreditation number of the environmental verifier and the date of validation.

2.1.2.6 Improvement in depth, width and development

Following the argumentation of Gastel (Gastel, 2005) we can divide the development of Environmental Management Systems into three dimensions:

1. Development dimension
2. Diffusion in depth and
3. Diffusion in width

The diffusion in width means the proliferation of the EMS system within the boundaries of the organization. The relevance of this dimension depends on the size of the

organization. Size in this context refers to different locations, departments, etc. The diffusion on width is dependent on the areas covered at the point of introduction of the EMS. For small organizations this point is of minor relevance as they typically include the whole organization into the first certification. For bigger organizations this point holds significance as it is sometimes preferred to start the introduction of an EMS in a restricted area of the organization. ISO 14001 and EMAS support this development dimension by offering the certification of selected functional areas (it is not possible to select parts of integrated areas and restrict it by this means to unproblematic areas).

The diffusion in depth aims to develop the EMS not in the direction of which areas are covered by the EMS system but in the direction of what is covered by the EMS. Increasingly more environmental aspects of the organization should be included in this development dimension.

The development dimension focuses on the qualitative aspect of the EMS system of the organization. Development in this area means the increase of the knowledge base and the understanding of the interrelations of the organizational system with its environment.

In this understanding, the development of an EMS focuses on the continuous improvement of the relation of an organization in the dimension of its environmental interaction in the sense of improving the input and output dimension. ISO 14001 and EMAS stays relatively vague on the procedural aspect of implementation (how this improvement should be executed – or better expressed how this growth of an EMS system should be organized). The two systems demand for top management support, resources, dedicated staff and employee involvement but does not mention further organizational requirements. Nevertheless, the growth of an EMS system has organizational and managerial implications.

2.1.3 Time

Under the time dimension we understand the connection between the past, the present and the future. EMAS and ISO in this sense give credit to the past. When an EMAS

management system is to be implemented the already existing environmental management practices and procedures have to be assessed. Moreover, the time dimension is especially accentuated in the aspect of risk and accidents. EMAS requires organizations to evaluate past incidents to draw conclusions in the present in order to avoid future accidents. Also, potentially risky activities have to be observed in the present in order to avoid or, at least be prepared for future occurrences and the mitigation of their environmental impacts. The possibility to assess potentially risky operations also draws on past experiences.

2.1.4 Memory

A communication as an event has merely no existence. In the moment it takes place it is already almost over. As systems are built through operations and operations can only exist in the present, organizational structure is only relevant in the present. For the explication of structure we have to consider memory functions. Only in the present can desired future states and aspects of the past that are represented in memory be connected. System structures by this “are expectations related to the connectivity of operations” (Luhmann N. , 2009). This connectivity of past with present and future decisions requires memory.

The aspect of organizational memory is very important in the EMAS and ISO 14000 family standards. In the case of risk assessment and preparedness it is required to execute periodically procedures that intend to cope with emergency situations. This dimension of operational memory however is not extensively developed in the standards. On the other hand both standards are very explicit on how the organizational memory, in sense of documented records, should be organized. We will review what the standards require to be documented, how the documents should be controlled – in other words how the memory of the organization is kept on its last evolutionary step - and how the long term memory in terms of records of the organization has to be established.

2.1.4.1 Documentation

(ISO) The environmental management system documentation shall include:

- the environmental policy, objectives and targets;
- description of the scope of the environmental management system;

- description of the main elements of the environmental management system and their interaction, and reference to related documents;
- documents, including records, required by this International Standard; and
- Training and educational records.
- Training and education needs recorded.

2.1.4.2 Control of documents

Every time the standards require a procedure to be “documented, implemented, and maintained” this procedure is part of the memory of the organization that is needed for its operation in the present. (It is not the scope of this thesis to give an overview on what procedures are mandatory for organizations to be maintained; in numerous publications lists of these requirements are available – for best reference we suggest the revision of the actual EMAS or ISO standard). In order to guarantee that the whole organization operates with the same revision standard the organization shall establish, implement and maintain a procedure(s) to (European Parliament, 2009):

- approve documents for adequacy prior to issue;
- review and update as necessary and re-approve documents,
- ensure that changes and the current revision status of documents are identified;
- ensure that relevant versions of applicable documents are available at points of use;
- ensure that documents remain legible and readily identifiable;
- ensure that documents of external origin determined by the organization to be necessary for the planning and operation of the environmental management system are identified and their distribution controlled; and
- prevent the unintended use of obsolete documents and apply suitable identification to them if they are retained for any purpose.

2.1.4.3 Control of records

The organizational memory must be organized in a way that allows demonstration of the organization’s conformity with the requirements of the EMAS or ISO standard. This means written records have to be kept as evidence of performance. This means there must be documents prepared that explain the present of the organization.

This organizational memory needs to be protected. Procedures that guarantee accessibility or location to the data (identification), procedures for the storage, protection, retrieval and retention have got to be established. The records stored shall “be and remain legible, identifiable and traceable” (European Parliament, 2009). Furthermore the organization is required to establish, implement and maintain procedures to abolish records – or in other words to forget.

2.2 Organizational consequences of EMS implementation:

As seen above, traditionally the analysis of environmental performance of an organization is executed with the use of input and output models (like energy and material balances, etc.) To some point this is the function of the environmental assessment. Both the EMAS and ISO standards follow this input and output model paradigm. Input and Output models tend towards black box model assumptions that are in danger of oversimplifying organizational reality. This oversimplification is to some degree diminished by the accentuation of the process dimension of the ISO and EMAS standards and the formal inclusion of the social environment and internal power structures into the standards. But still, the organizational internal reality includes much more than is addressed within a procedural and to some degree technical approach. For instance, by addressing environmental aspects of the organization the cognitive structure of the organization is widened. Furthermore, by establishing measurements to address the significance, the organizational value system is altered. But even more directly, as seen in the previous chapter, EMAS and ISO standards address the interested organizations with structural requirements. Empirical research by López-Fernandez and Serran-Bedia (López-Fernandez & Serran Bedia, 2007) addresses specifically the influence and consequences, the attention to environmental variables bring to an organization and its structure. Following Minzbergs model of organizational structure on centralization, formalization and specialization they found that the implementation of environmental management systems alter the organizational structure in the following ways (direct quote):

- The work of operators is widened to include greater formal demands and additional competencies and responsibilities, while the training and information

availability associated with the above changes appear to be limited to transmitting the essential information that relates to the specific environmental issues associated with the job.

- Related to superstructure design, process orientation was seen to be highly accentuated, in accordance with that proposed by ISO 14001. This can be viewed as an indication of a correct application not only of the formal aspects of the guidelines but also of their underlying philosophy and principles.
- The greater development of formal systems of planning and control is not circumscribed to the sphere of the operator positions but rather affects the company as a whole. We also observed an increase, although more moderate, in the use of liaison devices designed to provide greater fluidity in the transmission of information and in decision-making.
- The variation in decentralization depends on who receives the authority delegated. Decentralization in the direction of workers increased the least, which is consistent with the fact that the increase in worker vertical specialization was also small. Decentralization in the direction of experts exhibited the greatest increase, indicating companies' need to call on these experts (both in-house and external).
- The age of the certification, management involvement in the implementation process, and the existence of an ISO 9001 certificate are significant factors that contribute to explaining the intensity with which the aforementioned changes appear.

2.2.1 Change velocity

Panta rhei – everything flows - this aphorism attributed to Heraclites, is connected with the concept of change, noting that change is happening in every moment and no thing is static. The implementation of an environmental management system in the same way can be seen as an additional change within a constantly changing world. In this subchapter we will address the significance of the amount of change that happens in a certain period of time. Following considerations of Pirker (Pirker, 2007) we can think about the way the flow of change is developing. For visualization purposes we can express change as an accumulative amount of difference. This can be expressed by a linear equation of the kind:

$y=x*v_i$ (where y expresses the state at a point of time and v_i is the change velocity). Organizations normally are part of an industry (i.e. car industry), or sector (universities). Typically industries and sectors show a specific change velocity. In industries with a very fast innovation cycle, like the computer chip industry, there is a higher intrinsic change velocity than, for example, in the higher educational sector. The organizations in these industries are adapted to the sector specific change velocity. In other words, change within the intrinsic change velocity of a sector or industry is normal for regular daily business within these organizations. People and organizations within a certain sector are adapted to this change velocity. As a consequence, individuals and organizations in the chip industry experience a faster change velocity to be normal business compared to their counterparts in universities or in the mechanical watch sector who see a slower change velocity as normal. A linear curve suggests that change happens in the same amount on a regular basis over time. Yet, due to increased technological advancement and scientific achievements and interconnections it is nowadays commonly accepted that the accumulation of change is better expressed by an exponential curve. That the exponential curve can lead an organization to fall out or stay behind the typical sector change velocity is at this point of minor importance. Important is the fact that the implementation of an environmental management system into an organization cannot be classified within the general change velocity of the sector. It is better expressed with an extraordinary leap or step outside the general organizational adaption velocity. For the organization this means that it has to address the implementation of an environmental management system in a special way.

2.2.2 Change Levels

The distinctiveness of change as regular business or contrarily, as leaps is further developed by Groten (Groten, 2007) and Pirker (Pirker, 2007) who describe three different levels of change.

The smallest amount of change, which can still be perceived as being within the sectors intrinsic change velocity, is characterized as first level change. Pirker (Pirker, 2007) characterizes changes at this level as “[an] optimization [or change] that affects only some employees in a clear defined area of the organization”. Groten characterizes this change level as the level where “structures and targets only change minimally” (Groten, 2007).

Second level change is different. Here, “the organizational structure changes, functions get a new job description, processes change, targets are set differently” (Groten, 2007). Additionally “not only processes within a restricted part of the organization are being optimized, but the interconnection between organizational areas change. This also means that interfaces between different areas of the organization will be adjusted” (Groten, 2007).

Third level changes are better expressed by terms of restructuring or transformation. These are the widest reaching forms of internal change. This kind of change, typically, is connected with a crisis or with drastic happenings that affect the organization. “Characteristic for level three changes is that only the change is certain, the target and how to reach the target are blurry and uncertain” (Groten, 2007).

The environmental management system is a typical second level change - organizational structure, functions, positions, processes and targets of the organization changes.

2.2.3 Evolution and Revolution - Convergence and Upheaval

In a classic paper Greiner (Greiner, 1972) states that besides external forces on an organization there are also, and to a greater extent, internal historical forces acting as future determinants of an organization. The development of organizations is expressed as an ongoing evolutionary process. Evolutionary processes have an implicit time dimension. This means the progression of the organization in time. This time progression can be expressed in terms of organizational age. The second dimension can be seen in organizational progress. In this dimension organizational growth is addressed. That progress of an organization is connected with organizational growth (in size) is explicit in this model. These two dimensions, time and size are seen as critical factors of organizational evolution. The size dimension addresses the number of employees and distributional aspects of size as space. As organizations accumulate success over time they grow in number of employees and size. In an evolutionary adaptation, the organizations build on past experience and follow their historically successful patterns. These historically successful patterns lose their successfulness as success and size accumulates and turns into dysfunctional patterns. For organizations to stay successful it is important to see the

dysfunctionalities arise and prepare for a change in operations. In this revolutionary state, that is marked with substantial uncertainty and risk new organizational patterns need to be developed. These considerations express that each successful evolutionary stage of organizational development build up a potential of a crisis and creates the necessity of the next revolutionary stage. With the words of Greiner:

“As a company progresses through developmental phases, each evolutionary period creates its own revolution” (Greiner, 1972).

As size is the determinant in the model for organizations under growth conditions especially critical are aspects in the demand for coordination, communication and interrelations (See Figure 4 for illustration). Therefore the implications for the management are to be aware and prepared for important changes in the organization in order to sustain growth.

EXHIBIT II
The Five Phases of Growth.

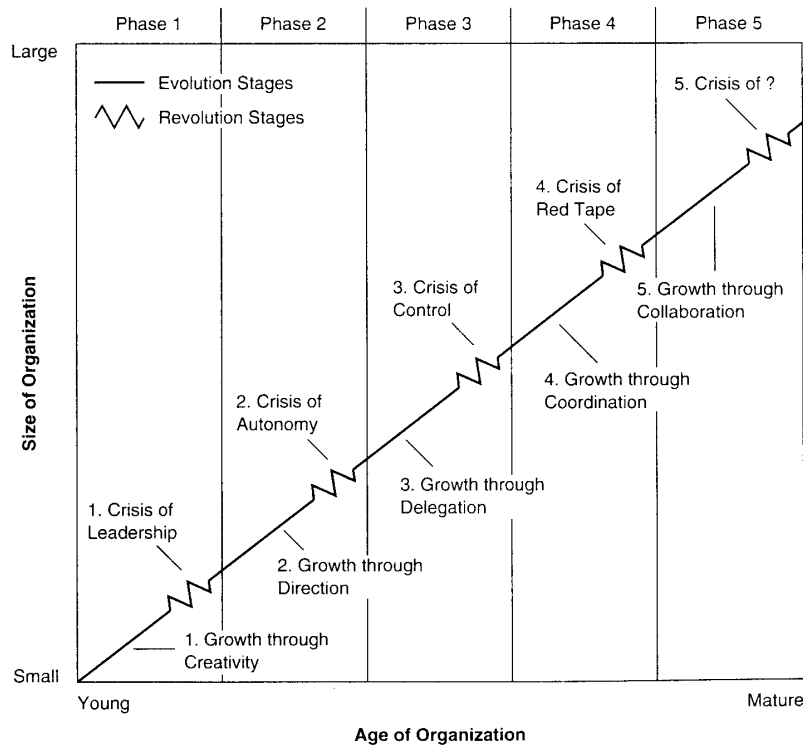


Figure 3: Phases of Growth (Greiner, 1972)

Tushman, Newman, and Romanelli (Tushman, Newman, & Romanelli, 1986) explore theory and empirical evidence in the same direction. They argue that:

“... periods of incremental change, or convergence, [are] punctuated by discontinuous or changes throughout the organization” (Tushman, Newman, & Romanelli, 1986).

The cause for this punctuation is seen wider here than in the model of Greiner, as lying anywhere in the environment or within the organization. While incremental changes in times of convergence are compatible with the existing organizational structure, in discontinuous or “frame breaking” change conditions sharp shifts in strategy, power, structure and controls are necessary. The organizational patterns differ significantly between periods of convergence and upheaval. In time of convergence organizations work on the refinement of policies, methods and procedures, the creation of specialized units and linking mechanisms, they develop employees in accordance to strategy, foster individual

and group commitment, promote norms, beliefs and myths, and clarify established organizational power structures. In times of upheaval other features like a reformation of Mission and Core values, an alteration of power structures and status quo, reorganization, change in interaction structures are envisaged.

2.2.4 Implications for the organization

Maybe earlier, but at least since the sixteenth century during the Italian renaissance it was seen that change may be difficult because of existing power structures:

“One must in fact be aware that there is no more difficult venture, no more doubtful of success nor more dangerous attempt to introduce as, ... a new order. For each innovator has all the enemies that had advantages from the old order and he has only lukewarm defenders in those who hope to gain from the new order or benefits. The laxity comes in part from the fear of the opponents, ... some of the distrust of the people who have real confidence in the new conditions only after they have been convinced of their durability. Hence it is that the enemies of the new order to attack this at every opportunity with all the passion and the others only defend weak” (Machiavelli, 1990).

The analysis of Machiavelli puts special attention to power structures. Especially when the innovator has not the power to introduce change by his own power – we could say top down – Machiavelli sees difficulties.

In more recent analysis, that is not limited to power structures as the classic analysis stated above, McKinsey quarterly conducted a survey in July 2008 where 3199 executives from industries and regions around the world participated. They state that “Organizations need to change constantly, for all kinds of reasons, but achieving a true step change in performance is rare. ... only a third say that their organization succeeded in doing so.” At the same time these “companies are investing an average of six months in planning their transformations” (Meany, 2008).

Cap Gemini, another consultant company, also made a survey about change management and arrived at similar results. “If a target reaching of 90 % can still be

measured as plain success only every eighth change project was successful (12.5%) if a target reaching below 50% is an evident failure every fifth change project (20%) was a failure. About two thirds of the change projects are between 60% to 80%. Furthermore 36% of the companies stated that “change management” is at the moment very important for them, 50% state that it is important and in total 92% state that they expect “change management” to be important for them in the future (Classen & Kjav, 2008).

In summary, organizations have to change a lot of things for a lot of reasons and it is likely that they will have to change even more in the future. As about 70% of the change efforts cannot be considered as successful; the resources spent in an average preparation time of 6 months, plus the resources spent during the implementation added together with the negative effects (like raising cynism, declining confidence in management) that failed change initiatives leave and may negatively influence future change efforts, managing change is an essential competence of success.

These two consulting firms draw their conclusions of the experience they have with their customers. Change in this sense means change where consulting firms are involved. Consulting firms typically are not involved in “easy fixes” like we would see in first level changes. On the other side – turn around situations where the whole organization gets restructured – are also rare. Most change efforts are located at the second level. We should expect that also for environmental management systems implementations, failure is more likely than success.

2.3 Role of Management in the Environmental Management System

Environmental management systems are normative, the internal organizational complexity, uncertainty, indiosyncratic ways of operation and structure are not directly reflected. On the other side, seeing that lots of change efforts are not successful does not make it appealing to rely on pure luck. To recognize the unlimited complexity that arises from structurally coupled systems does not help our considerations on environmental management systems implementation. Expanding the view of environmental management systems by complexity considerations is important because we expect to get better results including these considerations. We expect that complexity can be reduced to a certain level

and then regain complexity – in other words, that it can be organized. In this chapter we want to have a look at concepts of strategic management.

2.3.1 Concepts of Strategic Management

In the field of strategic management three major paradigms can be seen. Porters competitive forces approach, Shapiros strategic conflict approach and the so-named resource based perspective.

The five competitive forces Porter identifies – entry barriers, threat of substitution, bargaining power of the buyers, bargaining power of the suppliers, and rivalry among industry incumbents - target the organization's environment. By analyzing this relevant environment the organization can alter its position and generate strategic positions that will enable the organization to create and defend positions relative to its environment.

The strategic conflict approach centers on how organizations can alter or influence their environment in the sense of influencing the behavior of rival organizations and by this markets. One basic assumption is that by altering its environment an organization can yield increasing profits. To employ game theory is a common method in the strategic conflict approach.

The resource based view centers on the idea that organizations that have developed superior systems or structures can reach “markedly lower costs, or offer markedly higher quality or product performance” (Teece, Pisano, & Shuen, 1997).

For the implementation of environmental management systems these strategic concepts render different insights. Porters view centers on the strategic alignment of an organization towards an external environment can be interesting for universities to explore in question to positioning within the scope of competition between other universities for students, funding etc. regarding sustainability. The strategic conflict approach on the other hand could provide an indication on how universities may gain influence over other institutions or the society in general. Even micro-politic considerations within the organizational subsystems could be explored. For the scope of this thesis, these two approaches are considered of

minor importance on the question of environmental management systems implementation - the resource-based view however does have interesting assumptions that will be explored in the next subchapters.

2.3.2 Resource Based View

Historically the resource-based view leaves behind the market deterministic framework of the 1980s and puts the focus inside the organization. Where “Focus needs to be defined in terms of distinctive competences or capabilities, not products. Products are the manifestation of competences, as competences can be molded into a variety of products”(Teece, Pisano, & Shuen, 1997). Within this framework organizations can be assessed as “bundles of resources”(Eisenhardt & Martin, 2000). From a managerial perspective altering the resource base is necessary in order to obtain superior rents. Within this understanding strategic management focuses on strategies for exploiting existing firm specific assets (Teece, Pisano, & Shuen, 1997). Superior rents in the resource-based view can be realized in two different ways. First efficiency rents can be realized – where the resources base presents the possibility to offer products with lower production costs or higher quality – and second, Schumpeterian rents – that offer the organization superior rents that originate from innovation (Hölzner, 2009). The reason for these higher or superior rents lies in the development of superior internal systems and structures(Teece, Pisano, & Shuen, 1997). In other words, one basic differentiation between organizations is based in the possession of differing sets of resources and that these differences persist over time (Eisenhardt & Martin, 2000).

As organizations are the holders of resources and capabilities, organizations are the reference points not the individuals. From an analytical perspective the resource-based view can be seen within the paradigm of methodological collectivism (Hölzner, 2009). This means that characteristics on a macro level – we can assume here the organizational or departmental level – are not deductable from the lower levels. The whole is greater than the sum or its parts. This is an important characteristic as it gives connectivity to system theoretic considerations. However, we will not execute a systematic comparison and analysis of compatibility of these theories.

2.3.2.1 Resources

Resources are defined as “firm specific assets that are difficult if not impossible to imitate” (Teece, Pisano, & Shuen, 1997). These resources can be separated in tangible or intangible assets. Tangible assets in this context mean that they are physical in nature (e.g. production facilities, installations, etc.) whereas intangible assets refer to the non-physical part of organizational possessions (patents, licenses, etc). The difference to other concepts like competences is not entirely clear or agreed upon in the resource-based literature. Some scholars include abilities and competences within the definition of resources (Eisenhardt & Martin, 2000) whereas others see resources as not connected with actions. For our analysis we will include competences as resources. Skills, defined as “recurrent action patterns” on the individual level, however, may also be included as resources in the wider sense. The basic characteristic of skills is that they are generally not reflected, and repetitive in nature (Hölzner, 2009).

2.3.2.2 Routines

Routines can be seen as the equivalent on the collective level to skills on the individual level. Teece and colleagues express the importance of social interaction as follows:

“While individual skills are of relevance, their value depends upon their employment, in particular organizational settings. Learning processes are intrinsically social and collective and occur not only through the imitation and emulation of individuals, as with teacher – student or master – apprentice, but also because of joint contributions to the understanding of complex problems. Learning requires common codes of communication and coordinated search procedures. Second, the organizational knowledge generated by such activity resides in new patterns of activity, in “routines” or new logic of organization”(Teece, Pisano, & Shuen, 1997).

Routines are not tradable, intangible assets of the organization (Hölzner, 2009). They are “stable patterns of behavior that characterize organizational reactions to variegated, internal and external stimuli” (Zollo & Winter, 2002). According to Zollo and Winter routines are the outcome of experimental learning. From an evolutionistic point of view

they represent selection and retention of variation of behavior in the past. This connects the evolution of routines with learning processes that center on learning by doing. These routines possess a certain time dimension that puts focus on path dependency on one side and tacitness (Polanyi, 1966) on the other. From his tacit dimension of routines can be inferred that they are generally not reflected (Hözlner, 2009). Furthermore, the tacit character of routines implies a certain level of repetition. If the routines are not executed they may decay over time (Hözlner, 2009) (Zollo & Winter, 2002). Routines can also take an explicit character.

2.3.2.3 Capabilities / Competences

For the scope of this thesis the conceptual differences of organizational competences and capabilities does not render additional insight. In the following paragraphs we will use capabilities and competences as synonyms.

In the same way as routines, organizational competences are intangible and not tradable and operate on a collective level - social interaction and collective problem solving are key characteristics. The successfulness of problem solving is a further requisite of organizational capabilities. But one successfully solved problem does not by itself create a capability. For capability building repetition is important. The problem solving architecture must yield successful results in a repetitive way (Schryögg & Kliesch-Erbel, 2007). As the same problem never occurs in exactly the same way it is implicit that the capability needs to be somewhat robust and applicable in a variety of contexts. In this line of argument the implicit time dimension of capabilities can be addressed. They represent the historically evolved potential of the organization to combine resources with routines and organizational norms and values (Hözlner, 2009). That “capabilities cannot be bought but need to be built” (Cohen & Levinthal, 1990) is in this line of thought and stresses the aspect of learning. Capability building cannot be simply understood as learning by doing. The historical evolution of a capability that has shown to be successfully applied in the past adds a cognitive effort of evaluation to the concept. This means on one side an evaluation procedure exists and a frame of what can be considered as successful is implicit. Form analytic considerations can give insight on the organizational culture and value system by

analyzing what data is taken into account and converted into information in this assessment and what data is not considered. That the capability has shown itself successful in past occurrences is the base for the hope that it will also be successful in similar future circumstances. This emergent character of capabilities is the very nature of the strategic importance of capabilities. As they require time in their building process, and as they are partly implicit in nature and further dependent on idiosyncratic organizational characteristics like “organizational design, information procedures, micro-politics, and communication channels as well as other organizational characteristics [like] culture, control regimes, etc” , that are different in every organization, they are difficult to imitate (Schryögg & Kliesch-Erbel, 2007). Capabilities, in comparison to routines, have a wider coordinative character. Winter (Winter, 2003) characterizes organizational capabilities as higher-level routines, or collection of routines. An organizational capability cannot be understood solely as an organizational resource. It is the special allocations and combination of the resources that builds superior results (Schryögg & Kliesch-Erbel, 2007). The coordinating effect of competences Cohen and Levinthal express as:

“When firm specific assets are assembled in integrated clusters spanning individuals and groups so that they enable distinctive activities to be performed, these activities constitute organizational routines and processes. ... Such competences are typically viable across multiple product lines, and may extend outside the firm to embrace alliance partners” (Cohen & Levinthal, 1990).

Especially important for the organization or the organization characterizing competence is generally called core competence. As the concept of capabilities is defined in a relatively wide and theoretic way, the concept of capabilities can be applied in a variety of contexts. They can be built or established in different technical fields and organizational levels (i.e. on departmental, divisional or corporate level) (Schryögg & Kliesch-Erbel, 2007).

Capabilities can be assessed in terms of a capability hierarchy. Different levels of capabilities can be addressed. The lowest level is explained in a straight forward way by Winter: “Consider a hypothetical firm “in equilibrium”, an organization that keeps earning

its living by producing and selling the same product, on the same scale and the same customer population over time. The capabilities exercised in that stationary process are the zero level capabilities, the “how we earn a living now” capabilities” (Winter, 2003). Different to this basic level is the concept of dynamic capabilities that we will address in the next subchapter.

2.3.2.4 Dynamic Capabilities

The concept of dynamic capabilities differs from the concept of zero level or operational capabilities in the way that they are concerned with change. While the zero level capability typically is oriented toward the actual state of operation, dynamic capabilities concentrate on altering or recombining the resource base (Winter, 2003). In the same way Cohen and Levinthal define dynamic capabilities as:

“... the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organization’s ability to achieve new and innovative forms of competitive advantage given path dependency and market positions” (Cohen & Levinthal, 1990).

Eisenhardt and Martin define dynamic capabilities as:

“The firm’s processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die” (Eisenhardt & Martin, 2000).

In the same way as organizational capabilities, dynamic capabilities are intangible and not tradable and operate on a collective level – but the cognitive element that we have already discussed in the previous subchapters is widened in the concept of these definitions. The organizations cognition of its environment is the basis for the organizations active and innovative adaption. Form analytic considerations about the observation of the environment

of the organization may yield insight on relevancy assumption of the environment that exists within the organization. Further dynamic capabilities are to be thought of as a Meta level of ordinary capabilities. Learning mechanisms for instance, as they tend to alter the function of operational capabilities and routines can be understood as first level capabilities. Through these learning considerations the internal efficiency improvement dimension where dynamic capabilities address organizational reconfiguration and efficiency gains are also included. In combination with the understanding derived from the previous subchapter that organizational capabilities require to be employed in a repetitive way, dynamic capabilities address change in a systematic way.

From considerations of Winter (Winter, 2003) this systematization of change requires effort in its creation and repetitive employment of the capability and its underlying routines. This repetitive execution of capabilities requires and consumes organizational resources and is by that, from an efficiency point of view, not always advantageous as change operationalized through highly patterned capabilities is not the only way to execute change. Organizations "... might be pushed into "fire fighting" mode, high-paced, contingent, opportunistic and perhaps creative search for satisfactory alternative behaviors. It is useful to have a name for this category of such change behaviors that do not depend on dynamic capabilities, behavior that is largely non repetitive and at least "intendedly rational" and not merely reactive or passive. I propose, "ad hoc problem solving"" (Winter, 2003). While the maintenance of dynamic capabilities always requires resources in the case of "ad hoc problem solving" the costs practically disappear when there are no problems to solve as the personnel will have work to do at the zero level. Furthermore, due to the emergent and time-consuming character of capability building this also means a long-term commitment to a certain capability for the organization. These considerations lay out that capability building is not automatically advantageous but may also represent an expense in organizational resources. As Winter puts it:

"There is no hedge against every contingency. There is no general rule for riches. That investing in dynamic capabilities (or whatever order) can be a partial hedge against the

obsolescence of existing capability, can sometimes yield relatively sustainable advantage, ...” (Winter, 2003).

In especially fast changing environments the building of dynamic capabilities might be disadvantageous. They require time to develop – when the environment changes rapidly the time required for the development of capabilities might not long enough. Special external changes might also operate as competence destroying, rendering built competences or capabilities obsolete (Winter, 2003). Eisenhardt and Martin (Eisenhardt & Martin, 2000) address this with a distinction that in fast changing environments the dynamic capabilities are simple while in moderately changing environments the dynamic capabilities are detailed and complicate. That this represents an almost total flexibilization and dynamization of the organization stands against the very concept of capabilities as pointed out by Schreyögg and Kliesch-Erbel (Schreyögg & Kliesch-Erbel, 2007) and is problematic from a conceptual point of view is of not of further concern within this thesis as the environmental changes in the context of Universities is not likely to be considered as extraordinarily dynamic.

The concept of hierarchical levels within the concept of dynamic capabilities is local in nature. Organizational capabilities might be zero level capabilities in one context and first level in another. The development of a new product in a Research and Development department in an organizational setting might be considered a second order dynamic capability. If this new product development is executed within an independent Research and Development Laboratory this well might be considered as zero level capability (Winter, 2003). But also on a departmental level this might be separated. The new product development for the organization might represent a second order or dynamic capability while for the R&D department this is categorized as zero level operations.

From the partly tacit nature of capabilities and dynamic capabilities and their, to some degree, emergent and unplanned characteristics, dynamic capabilities are often perceived as a mysterious social phenomenon. Further from the conceptual side, as dynamic capabilities are sometimes defined as “routines to learn routines” they get in danger of endless

recursions and or tautologic argumentations. Following Eisenhardt & Martin (Eisenhardt & Martin, 2000) in their argumentation dynamic capabilities can be connected with real existing organizational phenomenon that rely on important research streams. The integrative nature of dynamic capabilities can be seen in product development routines. In transfer processes and replication in organizations, reconfiguration is addressed. Routines that allocate and distribute scarce resources, routines that coordinate the maintenance or coordination with other organization, knowledge creation routines, etc. are other examples.

That dynamic capabilities are different from organization to organization is evident from their evolving nature. Interestingly, similarities and identical elements can be seen between certain dynamic capabilities over different organizations. These similarities are often addressed with the concept of best practices. Again following Eisenhardt and Martin (Eisenhardt & Martin, 2000) that a certain equifinality does exist in organizational dynamic capabilities - is, to some degree, a contradiction to, or at least weakens, the resource-based view that organizational dynamic capabilities are unique to organizations. Immobility and inimitability of dynamic capabilities are becoming questionable. As mentioned above, it is this unique strategic position that generates superior efficiency or Schumpeterian rents. We understand with equifinality that by different means the outcome of the evolution of dynamic capabilities may be similar – or as Eisenhardt and Martin put it:

“These commonalities arise because there are more or less effective ways of dealing with the specific organizational, interpersonal and technical challenges that must be addressed by given capabilities” (Eisenhardt & Martin, 2000).

That commonalities exist across different organizations does not mean that they are identical – they only show similarities. But what is important to see is that the dynamic capability by itself is not the value for the organization but the outcome that gets produced by it.

2.4 Capability building for Environmental Management Systems

Both, ISO and EMAS standard, require the organizations that are interested in a certification of commitment to continuous improvement. As seen above, the commitment to

continuous improvement in the sense of environmental management systems is the ongoing improvement of the environmental performance of the organization. The standards follow Demings PDCA – Plan Do Check Act - cycle.

In the following subchapter we will overview the individual steps of this cycle that are foreseen in the standards. Later we will analyze the organizational significance of continuous improvement from a perspective of organizational capabilities on an organizational level. In a third step we will have a look at the significance on the departmental or subunit level. As a fourth step we will analyze capability building in the Environmental Management Group.

2.4.1 Organizational Level

First, in accordance to the environmental policy, the environmental program is planned (Plan). The planning procedure includes the development of organizational environmental objectives. The organizational objectives are then broken down by the development of environmental targets. These environmental targets are then connected with special efforts that should achieve the individual environmental targets. When these special efforts are put into operation in the organization (Do) the ongoing operation of the organization is altered. By accumulating evidence of the ongoing organizational operation an integrative function is exerted. The accumulation of evidence of the ongoing operation gives the evidence necessary to contrast the development of the organization towards its targets. In other words, evidence of the effectiveness of the organizational means and the efficiency of the organization in the execution of these means, is accumulated and contrasted against the environmental targets of the organization (Check). The checking in the two standards is executed in a double function. The first function is the assessment of the formal compliance of the organization with the requirements of the standard and the orderly operation of the organization. This function is executed mainly through the internal audits and external validations. The second function is the detection of achievements in the improvement in the environmental performance that is done mainly through the compilation of operational evidence that may be represented in the environmental statement of the organization. The management review is in both cases the instance that exerts the internal control function; external approbation is achieved through validation and communication through

information to the public. When in this checking, procedure discrepancies are found; counter measures have to be taken (Act). These counter measures may target the effectiveness and the efficiency of the environmental targets but also, the environmental objectives or in the last instance the environmental policy may prove to be inappropriate in certain dimensions. This can be understood as a development in height (Gastel, 2005) for the organization. Both, the ISO and the EMAS standards are explicit on how this organizational improvement process should operate and how it should be organized. For representation and visualization matters the following graph for the case of EMAS programs may be helpful:



Figure 4: PDCA - cycle - organizational level (own elaboration)

On an organizational level, the continuous improvement or PCMA cycle and the personal skills, routines, etc. can be understood as dynamic capabilities of the organization. It is important to see that the dynamic capability does not represent a special operation but the potential of execution of a continuous improvement cycle. The capability can lead to different concrete forms.

This over all organizational development and improvement however, is different at the departmental level. In both standards, the implementation process on its own is not greatly accentuated. As seen above, the ISO standard limits itself to the dimension of employee education on the organizational sub level while EMAS explicitly requires employee involvement in the whole environmental management system development process. In the next chapter we will analyze the implication at the departmental level.

2.4.2 Departmental Level

From the over all environmental objectives the individual environmental targets and the responsibility for these targets are developed. The operationalization of these targets means to bring them down to the departmental or group level. The responsibilities may well rest on certain individuals but the effort and result is collective in nature. In this chapter we will analyze the implications of the concepts of change velocity, change levels, capabilities and dynamic capabilities for the development on the departmental or group level. Later we will analyze the concept of convergence and upheaval in connection with the development of the environmental management system in depth, width and development and its special implications for the environmental management group.

2.4.2.1 Change Velocity

On one hand the change velocity in organizations of higher education like universities can be seen as extremely dynamic. In the area of research and education many innovations and new knowledge are created from within the organization or, is introduced into the organization from external sources. On the other hand, the formal operation of organizations of higher education may be considered as more or less stable with a reduced sectorial intrinsic change velocity. On the operational departmental level the sector specific change velocity may well be characterized as lying on the lower end of a hypothetical velocity scale. This means that for the involved departments the implementation of environmental management systems represents a special situation for the departments and the individuals that from these departments.

2.4.2.2 Change Levels

As seen above, the implementation of an environmental management system means a second level change for the organization. If organizational structure changes and when certain functions are set up or existing ones experience change, this will have important implications on the organization. A change in the target structure of the organization, as explicitly intended with the introduction of environmental management systems will certainly add to the significance. The execution or introduction of a second level change in the organization develops its operational meaning not only in the interaction of different departments, but is reflected in the departments accordingly.

Taking into consideration the findings of Cap Gemini (Classen & Kjav, 2008) and McKinzie (Meany, 2008) that change initiatives are generally in danger to render insufficient or at least less than the expected results, the departmental and individual level of the organization should be expected to influence the results of environmental management systems implementations.

2.4.2.3 Capabilities and Dynamic Capabilities

From a strategic management and organizational level perspective the operation of an organization with an especially good or outstanding environmental performance can be seen as an organizational capability. It is highly coordinative; this means it allocates the organizational tangible and intangible assets in a special way. Furthermore it includes different recurrent social interaction or action patterns or routines, and builds on individual recurrent action patterns or skills.

For this, EMAS and ISO require the organization to build the capability for an especially good environmental performance operation. The Deming Cycle and the idea of continuous improvement that is explicit in the standards adds an aspect of change to this capability. The reconfiguration of the organizational assets for the improvement of the organizational environmental performance, the development or the acquisition of new assets and the disposal of no longer advantageous assets requests the building of a dynamic capability. The above-described process of PDCA cycle expresses this dynamic capability.

2.4.2.4 Convergence and Upheaval in Environmental Management Systems

The development of an environmental management system in depth, width and development dimension (Gastel, 2005) puts the attention onto time and away from the aggregated organizational view down to the group and departmental level.

We can start with the implications the widely used word “implementation” has for our analysis. To implement something means to put something into effect. The process of doing so – the “implementation” implies time consumption. It is difficult to be perceived as something that does not exist that then gets implemented and, in the next perception of an especially short passage of time; it comes into existence and is showing effect.

Conversely, the disaggregation from the organizational level down to the departmental or group level adds a certain space dimension to the concept. The implementation of an environmental management system cannot be perceived as being monolithic. An organization consists of different departments that are concerned with different environmental aspects – but even more important is that these departments have different organizational functions. Especially in universities, if we perceive them as loosely coupled systems (Weick, 1976) the atomization or the disaggregated view of the organization is imperative.

From the time and space dimension we can perceive sequential processes. The sequences might be executed in parallel or consecutively or, in a mix of both and each sequential step requires its own time and can be perceived as a process.

From a departmental point of view the implementation process can be described as extraordinary, not in the perceived natural change velocity, but as in the words of Tushman, Newman and Romanelli (Tushman, Newman, & Romanelli, 1986) as an upheaval condition for the department or group.

From the time dimension we can make a distinction between upheaval and convergence conditions. They both exist at the departmental level but not at the same time and as we may see later not necessarily in the same place.

This leads us to the idea that for sustaining the growth of EMS systems, organizational operations are required which stand perpendicularly to the continuous improvement process on which the environmental management systems standards focus. Organizational capabilities and dynamic capabilities must be developed that on one hand support operation and continuous improvement activities or convergence situations and on the other hand enable the growth of the environmental management system in width and depth suggesting the handling of upheaval conditions at a departmental level.

How can a department or group generate an upheaval condition in a context that is not known inside the department? A department is required to handle a situation where no absorptive capacity, in the sense of Cohen and Levinthal (Cohen & Levinthal, 1990) exists. This is a paradox situation. This paradox situation can be solved by a separation in space. Typically the environmental management group or the steering committee exercises this function of depth and width development meanwhile the convergence situation in the sense of continuous improvement is handled within the departments.

2.4.2.5 Environmental Management Group

While on the departmental level, zero level capacity is located in the operational level and convergence situations may be understood by the concept of continuous improvement at this organizational level. By this, they can be understood as first level or dynamic capabilities. For the environmental management group the coordination of upheaval conditions within the different departments is a zero level capability. This capability may include important routines that are oriented towards educational efforts for the building of absorptive capacity within the target departments or certain participatory methods as well as individual skills. For the environmental management group or steering committee the building or evolvement of superior zero level capabilities can also be explained or

expressed by learning mechanisms. As such, dynamic capabilities are also a concept for the continuous improvement in the steering committee.

2.4.2.6 Evolution and Revolution

It can be expected that within the steering committee or the environmental management group certain modes of operation evolve. The evolution of the dynamic capabilities within this group is developing. Following the concept Greiner (Greiner, 1972) we might expect that while growing in coverage and success an administrative crisis in the development group is building up.

In summary, for the operational level the building of operational capabilities and the continuous improvement of them can be seen as the evolvement of organizational capabilities. The concept of organizational learning seems to be of importance in this context. For the environmental management group the emergent capability of developing the environmental management system in depth and width and the connected routines and skills and its improvement are being converted by the learning mechanism also. Furthermore, for the steering committee, the zero level capability includes the management of departmental upheaval conditions.

In the following two chapters we will analyze aspects of change management for upheaval conditions and literature on organizational learning for the aspect of continuous improvement. These chapters will include considerations of organizational theory, psychological and sociological considerations, theoretic positions, empiric findings and practical aspects. We cannot develop each research stream in greater detail. The intention of these chapters is to present interesting aspects of change management and organizational learning without considering theoretic consistency of the different concepts.

2.5 Capabilities in Change Management or upheaval

Change Management is related to the perception of discontinuity (Weick & Quinn, 1999). The basic assumption is that there is a special need to change – or an upheaval condition. This special need for change can be introduced in different ways. From a time perspective it can either built up over time (Pirker, 2007) or it can be felt necessary because

of a special shift – like changes in legal requirements for the organization. From a system theoretic point of view a discrepancy of alignment of the organizational system to its relevant environments is the cause and the perception, cognition or recognition of this discrepancy is necessary. The idea of a threshold is implicit – when the cognition of the discrepancy of alignment passes a certain level, the organizational system seeks an improvement of adaption. In order to overcome a threshold there is also a target, setpoint, performance or strategy aspect implied. With other words, change is triggered from deviation. Structural considerations or individual systems characteristics may influence cognition. The cognitive aspect of discrepancy also adds a dimension of intentionality. Once a discrepancy is detected and the threshold of deviation is reached the perceived gap is to be closed with an intentional effort from the organizational system. This intentionality leads to a dimension of rationality or weighting. The intentional elimination of the perceived discrepancy opens the field for considerations of efficiency and effectiveness and with this the development of a form – but even more important it opens considerations of planning. The efficient and effective elimination of the discrepancy is likely effectuated with the development of a plan. In a means – ends consideration the means can be perceived as the elimination of the deviation and the means should show themselves as efficient and effective in the elimination.

2.5.1 Process and content dimension

Historically, change management separates two different aspects. The content dimension that concentrates on the question what change is to be brought into the organization. This first area typically is connected with an approach that comes from natural sciences - to some content relying on a machine model. In this area we are thinking about hierarchies, planned communications, techniques, For the implementation of environmental management systems the content dimension includes the considerations on the relevant environmental aspects, environmental targets, the environmental program, and so on.

The second aspect is oriented towards the way this change is implemented – the process dimension. Whereas the content dimension is marked by natural sciences, the process dimension roots in humanistic sciences.

Also from the technological nature of environmental management systems and their related standards like EMAS and ISO 14000 the aspect of content dimension is relatively pronounced. In the following chapters we will concentrate on change related aspects of the process dimension.

2.5.2 Change cycle

Important for the development of the field of change management is Kurt Lewin's Field Theory. His Field Theory is a systems approach where a field is defined by Lewin as "the totality of coexisting facts which are conceived of as mutually interdependent" (Remage & Shipp, 2009). These coexisting facts are factors in the environment of individuals or groups that influence their behavior. For Lewin the individual behavior was a function of the person and its environment. He expressed that in the famous formula $\text{Behavior} = f(\text{Person, Environment})$. When working with North American housewives during the Second World War in efforts to change behavior in the perception of acceptable food (i.e. liver) (Schreyögg, 2008) he developed a model of change that consists of three stages:

1. Unfreezing
2. Moving
3. Freezing

The key assumption is that a field or a system of coexisting facts is in a balanced state. Lewin refers to this state as "quasi stationary equilibrium". In order to change this balanced state factors within the system must increase or accumulate in order to overcome the balancing forces of the field to enter in the second state, the moving state. Once the changes have been enacted Lewin identifies a freezing state in which the newfound field equilibrium requires to become permanent.

The "quasi stationary equilibrium" with its underlying assumption of homeostasis implies that a system has an internal force that keeps it in its actual state. The system has an inbuilt type of resistance - a resistance to change. Following Dent (Dent & Galloway Golderg, 1999) the original concept of resistance to change for Lewin was that of "work

taking place within a system of roles, attitudes, behaviors, norms and other factors, any and all of which could cause the system to be in disequilibrium”

2.5.3 Individual perspective

2.5.3.1 Readiness for change

The idea of the unfreezing phase in Lewin’s Field Theory opened a new field of investigation and research. For the field of readiness for change the question “How this instability of can be deliberately created?” is the eminent subject. The research area is divided into two main areas. The first is focused on the change target, whereas the second concentrates on the change agent. Change agents are supposed to initiate or facilitate change. In discontinuous change efforts the change agents have the role of primary movers who create change. They focus on the inertia and destabilization homeostatic forces. The change agents are working on the change of the organizational meaning system (Weick & Quinn, 1999). It is their job to generate some kind of change momentum – whereas change targets are the subjects that are supposed to change. These people typically are located on the lower end of the hierarchical ladder. Although, in the periphery and out of the scope of the mainstream of the organization, “positive deviants” may have already switched to a different innovative practice (Tanner Pascale & Sternin, 2005). The problem here would be to spot them out and spread their way of practice.

Armenakis and Harris (Armenakis & Harris, 2009) identified five key believes that seem to underlie change recipients motivation to support change efforts:

- *Discrepancy* refers to the belief that a change is needed; that there is a significant gap between the current state of the organization and what it should be.
- *Appropriateness* reflects the belief that a specific change designed to address a discrepancy is the correct one for the situation.
- *Efficacy* refers to the belief that the change recipient and the organization can successfully implement a change.
- *Principal support* is the belief that the *formal* leaders (i.e., *vertical* change agents) in an organization are committed to the success of a change and that it is

not going to be another passing fad or *program of the month*. Furthermore, we include as principals the *opinion leaders* who can serve as *horizontal* change agents.

- *Valence* reflects the belief that the change is beneficial to the change recipient; there is something of benefit in it for them.

2.5.3.2 Individual resistance

Over time, this systemic view on organizational change and the concept of resistance to change lying anywhere in the systems has transformed and has been perceived as a psychological issue (Dent & Galloway Golderg, 1999). On one hand the development of seeing resistance to change on the psychological aspect of the individual system has lead to an extremely rich stream of research on individual resistance to change – on the other hand, the aggregated view of the concept gets problematic in different ways. On one side, resistance to change can be easily used for managers to disguise bad management thus using resistance to change as a scapegoat. Poorly planned and executed change efforts by management naturally run into trouble and executives justify the occurring problems by encountered resistance to change; not in the poor or wrong planning execution of the effort. Furthermore, the concept of organizational change and resistance to it is difficult as it supports the managerial side in an unsymmetrical way. “The language "resistance to change" labels, with the deegratory term "resistors," those who happen to disagree with a change idea. Since the phrase is commonly employed by management to refer to the rank and file, the term automatically validates the change approach of management and discounts any concerns of others as "resistance” (Dent E. B., 2002).

Further the monolithic use of the word change is seen as problematic. A lot of different things can change and a lot of changes are positive in nature and are actually embraced by people. The aggregated view on resistance to change might even jeopardize change efforts as specific action to specific problems might be covered and disabled by this generalizing view (Dent E. B., 2002). People do not resist change as a general concept, they rather resist special disadvantageous circumstances like (Greenberg & Baron, 2008):

1. Economic insecurity: the loss of income or the loss of job can put into danger the employees' livelihood.
2. Fear of the unknown: Employees derive a sense of security from doing things the same way, knowing who their coworkers will be and whom they're supposed to answer to from day to day. Disrupting these well-established, comfortable patterns creates unfamiliar conditions, a state of affairs that is often rejected.
3. Threats to social relationships: As people continue to work within organizations, they form strong bonds with their coworkers. Many organizational changes (e.g. the reassignment of job responsibilities) threaten the integrity of friendship groups that provide valuable social rewards.
4. Habit: Jobs that are well learned and become habitual are easy to perform. The prospect of changing the way jobs are done challenges people to develop new job skills. Doing this is clearly more difficult than continuing to perform the job as it was originally learned.
5. Failure to recognize need for change: Unless employees can recognize and fully appreciate the need for changes in organizations, any vested interests they may have in keeping things the same way overpower their willingness to accept change.

Following the argument of Dent the justified resistance to badly planned and or not adequate change efforts should be added to this list.

2.5.4 Organizational Perspective

From a system theoretic perspective the person and the psychological system are loosely coupled. There is no way to influence them directly. The impossibility to know what is going on in an individual sense system does not make it impossible to have influence but it at least makes it a random process. On the other side, decision premises are also loosely

coupled with decisions, but at least the organizational system has influence on the decision premises that are deliberately enacted through decisions.

The thinking in systems is the cornerstone of Peter Senge's book "The Fifth Discipline". In a computer simulation that was played by thousands of participants over several years, with ever-recurring disastrous results. The key finding were that behavior has to be abstracted from the individual, and that the structure was responsible for the behavior of the participants (Senge, 2006).

It is important to outline that this systemic structure is "the key interrelationship that influences behavior over time" (Senge, 2006). Although psychological systems are only loosely coupled to the organizational system, the consistency of similar results as outcomes of the simulation indicates that behavior can be attributed to systemic structure – changing the structure results in changes in behavior. Structure also includes the "operation policies" of decision makers. If we redesign the decision making policies we redesign the system structure and with this, behavior. Participants in the simulation were not aware of the underlying structure of the simulation – but were especially surprised that their way of thinking and so their internal systems structure had had severe influence on the catastrophic outcome of the game. As consequence that structure causes behavior, we must give up the idea of personal responsibility but inquire deeper into the underlying structure. For this type of systemic thinking it is necessary to shift the mind to focusing on interrelationships and connections rather than thinking in schemes of cause and effect and seeing processes rather than snapshots. Senge (Senge, 2006) advocates to focus on dynamic complexity not detail complexity.

Out of a cognitive tradition "What we see depends on what we are prepared to see" Senge advocates a shift of mind. To understand what is at work, it is necessary to develop an understanding of circular connections and how they influence each other. Positive or amplifying feedback loops are responsible for growth patterns in circular connections whereas negative balancing feedback loops are responsible for goal-oriented interaction.

As it is known from cybernetics, many feedback loops operate with time delays. This makes them difficult to detect. Learning requires observing results from action - time delays in response makes them difficult to detect and in turn difficult to learn. This fact is known also known from Pavlov's early experiments (Myer, 2008). This is even more true when we have a difference in space. When the response occurs in a not observable distance.

Thinking in circles and feedback loops also helps to see that from a systems point of view every effect is a cause for something else. When we want to understand how an organization works we need to be aware that feedback loops can be explicit and implicit and that if we want to understand the organization fully we must know them both. For implicit feedback processes further complication arises from the fact that the governing value is not deliberately set. If this set value is not in accordance with the organizational intention the first need is to discover its very existence.

This gives support to the above-mentioned resistance to change chapter. When we are in a change processes, operating an intended explicit positive feedback loop, the system often responds with a limiting negative of balancing loop that balances the efforts. As Senge says:

“Whenever there is resistance to change, you can count on there being one or more hidden balancing processes. Resistance to change is neither capricious nor mysterious. It almost always arise from threats to traditional norms and ways of doing things. Often these norms are woven into the fabric of established power relationships. The norm is entrenched because the distribution of authority and control is entrenched. Rather than pushing harder to overcome resistance to change, artful leaders discern the source of the resistance. They focus directly on the implicit norms and power relationships within which the norms are embedded.”

Or in the words of Watzlawick:

“More of the same is not necessarily better” (Watzlawick, 2008):

In order to help successfully identify underlying structures on an operational level Senge specifies “Certain patterns of structure [that] occur again and again. These system “archetypes” or generic structures embody the key to learning to see structures in our personal and organizational lives. The system archetypes,... , suggest that not all management problems are unique,...” (Senge, 2006).

We will limit us to mention only the:

1. **Limits to growth:** A reinforcing (amplifying) process is set in motion to produce a desired result. It creates a spiral of success but also creates inadvertent secondary effects (manifested in a balancing process), which eventually slow down the success. – this is close to the considerations of Greiner mentioned above.
2. **Shifting the Burden:** An underlying problem generates symptoms that demand attention. But the underlying problem is difficult for people to address, either because it is obscure or costly to confront. So people “shift the burden” of their problems to other solutions – well intentioned, easy fixes which seem extremely efficient. Unfortunately, the easier “solutions” only relieve the symptoms; they don’t solve the underlying problem. The underlying problem grow worse, unnoticed because the symptoms apparently clear up and the system loses whatever abilities is had to solve the underlying problem.

The following quotes may underline that the system intrinsic structure is responsible for the failure of many initiatives:

“Growth trends at many universities have resulted in many university administrators, faculty and perhaps even students experiencing the greatest workloads they ever have. This increase in the “energy load on the system” is resulting in greater inefficiency in dealing with current problems as well as inhibiting the capacity to address new problems – such as the environmental imperative. If we do manage to get the environmental imperative on the agenda of university decision-makers it is often seen as a late arriving competing priority

that will have to wait its turn to be addressed - and who knows when this will be” (Sharp, 2002).

“The most problematic barriers to institutional environmental efforts at Talloires signatories are higher priority of other initiatives, lack of funding, and lack of time” (Shriberg & Tallent, 2003).

Forty seven percent of the participants in Classens research were of the opinion that “too many priorities that are not prioritized“ are one of the strongest impediments for success (Classen, 2008).

Talking about universities: “The institutions that claim the position of the premier and most advanced knowledge producers in society frustrate learning and social change in most of their internal processes and their articulation with the surrounding society” (Gutz, 2004).

“... We’re in a research-intensive university where the highest prestige is attached to theory . . . except in applied areas, professional schools and so on. But in the other faculties, being applied is not necessarily . . . highly rewarded so sustainability implies a level of commitment to an applied focus that is not necessarily rewarded as strongly. The general view is . . . it’s ok to do it. It’s even seen positively, but only if you do everything else first, if you do the disciplinary work, . . . So it’s like a double jeopardy situation . . . [F]inding a mix is not the answer. It’s about doing more.” (Gutz, 2004) (in the same line of argument (Michel, A. 2008) and (Schönwald, 2007).

Greenberg and Baron (Greenberg & Baron, 2008) specify as organizational barriers to change:

- 1) Structural inertia: The resistance that arises out of the built in organizational forces for stability
- 2) Work group inertia: Social expectations of people working within a group

- 3) Threats to existing balances of power: Changes always have the potential of redistributing expertise and power for certain groups or individuals within an organization. This resistance can result from whole organizational units.
- 4) Previously unsuccessful change efforts: The historical path of an organization, may act against new change efforts

2.5.5 Intervention – the example of process consultation

In the area of organizational development, change management, systemic consulting, etc. there are a huge variety of intervention or procedural methods that target change. It is typical that the requirements for the people applying them are considerably high. They need to be highly trained in the application of the methods and have a certain level of experience. It is not part of this thesis to review these intervention tools. But, we consider that with the help of the revision of an especially widespread concept like process consultation we can show the relevance of these methods for the building of dynamic capabilities. (By replacing the word consultant with, for example members of the steering committee, or upheaval coordinators it is easier to recognize the significance of this subchapter) In the presentation of process consultation we rely on Schein's classic book on Process Consultation (Schein, 2003).

Schein's definition on Process Consultation is: "Process consultation is the creation of a relationship with the client, that enables the client to see processes happen in his internal and external environment and to react and improve on these processes in the way he defines them" (Schein, 2003).

Consultants can hold different positions in order to act toward the client system. The first position is the position of an expert. The expert tells the client system what to do. The second is the position that is best explained by the representation of a doctor-patient relation. The doctor analyses the patient and prescribes a medicine that will cure the disease. The third position is Process Consultation.

The underlying assumption of Process Consultation is that in the beginning phase of a helping relationship neither the client system nor the consultant knows what the problem is

and what might help. All organizations have strengths and weaknesses. Only joint exploration of the context can open insight. The consultant may never get to fully understand what would be the most appropriate way to approach an issue or what information might help in the problem. This is because the way members of the organization process their information is rooted in their traditions and unspoken assumptions that are part of the organizational culture and the personality of their decision makers and members.

In order to develop a deeper understanding of the context, the consultant must realize what he does know, what he thinks he knows and what he does not know. Only when he is aware of his internal reality can he inquire into the actual reality.

Every contact of the consultant with the client system is an intervention. As every contact delivers new information for the consultant, every contact gives input into the client system. The consultant needs to be aware and take responsibility for this.

The problem and the solution for the problem are always in the hands of the client system. Only the client has to live with problems and solutions. The consultant cannot take over this responsibility.

Each client system has its own culture and creates and maintains its own stability. Each client develops his own personality and way of doing things. The consultant needs to inquire where the client is motivated to change. This is what the consultant can work with.

Sometimes the next step to take is not clear for the consultant; in this case he jointly develops the next steps with the client.

2.6 Capabilities for Learning Organizations – or convergence

Peter Senge (Senge, 2006) speaks about change or learning in organizations as an ongoing process. In his concept of organizations and individuals, they (the organization and the individual) have to exercise in certain disciplines with the aim of improvement. This has the implicit notion that they will never arrive.

Organizational learning has a different focus than organizational change. As described above, organizational change is connected with the idea of intentionality and rationality. First, the change necessity is spotted, in a second step the change is planned and finally executed. Ongoing change on the other hand is different; the notion of intention and planning is replaced by a concept of emergent change. Emergent in this sense is that it would be always possible in a different way. The underlying assumption is the system theoretic concept of self - organization of the system. Weick and Quinn (Weick & Quinn, 1999) see the concept of ongoing change connected with the concepts of improvisation, translation, and learning. Improvisation in this sense has a time dimension. What makes and improvisation an improvisation is the temporal proximity of “composing and performing, designing and producing, or planning and implementation” (Moorman and Miner in (Weick & Quinn, 1999)). A system theoretic explanation of translation in an organizational setting may follow a two step sequence of reduction of complexity and creation of complexity or reduction and generalization in the sense of Luhmann (Luhmann N. , 2009). Out of a special situation an idea is generated and in a way in existent - or in a latent existence - within the organization. This idea then may be generalized or translated into another context. Translation in this sense is not an active promotion of the idea but rather the generalization or adaption in another context. Learning, as the third aspect “learning is one of a setting where work and activity are defined by repertoires of actions and knowledge and where learning itself is defined as a “change in an organization’s response repertoire” (Sitkins et al 1998 in (Weick & Quinn, 1999)). It may limit the concepts of improvisation, translation and learning in a certain way but they can be expressed by evolutionary thoughts. Variation may be generated by improvisation; this variation can be seen as emergent – it could have been done differently. When this variation can be translated within the organization – or it is generalized in another context – a selection process is executed. Learning in this sense may represent the repetition of the variation; or the alteration of the response repertoire of the organization. Whereas in organizational change, the focus is on replacing; replacing existent structure, routines, techniques, personnel, culture, etc. The focus in organizational learning is on changing. Changing in comparison to change (Weick & Quinn, 1999).

2.6.1 Personal Perspective

We feel that the personal perspective of learning, in organizations of higher education, where education and personal development is the prominent organizational operation, a review of personal learning in areas like education, and individual learning could not bring additional insight.

We will however, have a look at learning disabilities that might be in cognitive systems in the following subchapter.

2.6.1.1 Learning disabilities

The ongoing change in organizations is the desired state of organizations. This ongoing process can be affected or suffer distortion either from the organizational system or from the loosely coupled individual or personal systems.

Individuals represented as cognitive system raise an interesting question on how these cognitions work or how they are organized. Piaget, when observing the development of children, developed awareness that the way we understand the world develops through certain concepts Piaget called “schemes”. He understood schemes as a kind of cognitive structure in which our experiences are organized. As adults we possess a huge variety of different schemes that include what we understand to be a dog, cat or love. For Piaget the building of a scheme is developed through a two-stage process. New experiences get assimilated – this means the new experience is interpreted with the existing schemes and in a second step the scheme adapts to the new experience – it gets accommodated (Myer, 2008).

From cognitive psychology we can learn that on the other side we also see what we are prepared to see. The combination of experiences, suppositions and expectations can generate a perceptual set – a predisposition on what we will see (Myer, 2008).

The developed schemes, dependent on the individual history, determine how new experiences are interpreted and on the other side, the experiences and with this the schemes

may also determine what the individual observes. Senge (Senge, 2006) talks in this context of mental models and dedicates a discipline to it.

As mental models develop over time and become increasingly implicit and furthermore, have the potential to stay implicit, they probably stay unexamined. The gap between mental models and the world around us is potentially widening as the exterior changes. This leads to maladapted cognitions and actions. From a system theoretic consideration we can see here a problem of reduction of complexity in the development of a mental model and its application to another context, the generalization. Senge would say that we have to be aware of “leaps of abstraction” (Senge, 2006). From Piagets understanding we could maybe see a lack of accommodation.

How does this influence the organizational learning process? If the cognitive structure of the individual builds over time and the assumptions that build the mental model do not get observed or tested as to whether they hold “truth” or represent the world in an appropriate way, the individual might get a “wrong” image of the environment. If the individual perception of the world is systematically blurred through maladapted mental models their usage will have consistently maladaptive consequences. Senge advocates that “the discipline of working with mental models starts with turning the mirror inward; learning to unearth our internal pictures of the world, to bring them to the surface and to hold them rigorously to scrutiny” (Senge, 2006). The ongoing training of the discipline means a continuous testing and adaption of the mental models.

The personal contribution to learning disabilities gets a slightly different turn in Argyris concept of espoused theories and theories in use (Argyris, 1991). People cannot rethink every situation in every detail. As described above, people develop certain schemes – Argyris refers to them as theories of action. When people are asked in surveys or interviews they refer to their theories of action as they understand them. These are their espoused theories. Interestingly Argyris, drawing from decades of experience in the field, found that the way people express their theories is inconsistent with their actual actions. Their actual actions are expressed by their theories in use – which are inconsistent with their espoused

theories. The theories in use rest typically on certain governing values (e.g. to remain in unilateral control, to maximize winning and to minimize losing, to suppress negative feelings, to be as rational as possible,...). “The purpose of all these values is to avoid embarrassment or threat, feeling vulnerable or incompetent. In this respect the master program that most people use is profoundly defensive. Defensive reasoning encourages individuals to keep private the premises, inferences and conclusions that shape their behavior and to avoid testing them in a truly independent, objective fashion”. It is this kind of defensive reasoning that in this sense blocks learning. The difference between how we think we act and the way we act, supported by defensive reasoning inhibits learning.

Out of a constructivist tradition the intra-psychological processing might lead to misconceptions. With this we scratch Gestalt psychology and cognitive psychology that cannot be developed in the scope of this thesis. For this, it is most important to know what is going on in the own mind. The complexity of the intra psychological processes is due to the fact that our nervous system simultaneously observes (O), reacts (R), analyzes, processes, makes judgments (J) and intervenes in order to make something happen (I) (Schein, 2003). In this process there are several traps, when we observe we may misperceive, on what we observe we may react inappropriately, we may react rationally - but based on bad data, and in the end we might intervene in an incorrect manner.

There is a rich research stream on personal behavior and attribution in psychology which we cannot treat in detail in the scope of this thesis (we are in the area of perceptual biases like, fundamental attribution errors where “the tendency to attribute their actions to internal causes while largely ignoring external factors that also may have influenced” (Greenberg & Baron, 2008), halo effects with their tendency “for our overall impressions of others to affect objective evaluations of their specific traits, perceiving high correlations between characteristics that may be unrelated” (Greenberg & Baron, 2008) similar to me effects, or selective perception, etc.). It is, however, important that there is evidence that in the psychological systems that are loosely coupled with the social or organizational system there can be found systematical distortions. Maybe it could be possible to think that, if individuals are represented in the social system by the concept of persons with a more or

less stable appearance, the appearance of the person would appear different, if the theories in use and the mental models would be under subject of testing.

To follow Luhmann (Luhmann N. , 2009) the only operation of a social system is communication. Senge and Argyris propose the use of dialogue in order to suspend the personal assumptions and surface them publicly for social testing. In organizations, in order to be able to learn, the skills of dialogue and advocacy have to be built.

Considerations of Schein (Schein, 2003) on communication and feedback go in the same direction. From a communicational point of view it is important to observe that we deliberately restrict the conversation of things that we do not want to communicate but we are aware of. On the other hand, we communicate things to others that we are not aware of and there are underlying factors that remain hidden. The feedback processes intends to widen the field of the public self in the direction of the blind spot window.

To visualize humans in a simplified way Schein uses the Jahori–Window (see figure 5)

		Known to self	Unknown to self
Known	to	My public self	My Blind Spot
Unknown to others		My hidden self	My unconscious

that was introduced by Luft in 1961.

Figure 5: Jahori – window (Schein, 2003)

- The “my public self window” represents the properties of ourselves that we are aware of and that we show deliberately to others.
- The “my hidden self window” represents the properties that I want to hide from others.
- In the “my blind spot window” what is unknown to ourselves but is observable by others is represented.
- The “my unconscious self window” represents our unconscious that is also hidden from others. Located in this area are implicit knowledge, underlying feelings and hidden potentials.

2.6.1.2 Absorptive capacity

In the discourse of organizational capabilities, the concept of absorptive capacity, is important. This concept was developed in the context of R+D departments in organizations. Although developed in a different context for the implementation of environmental management systems, it can give interesting insight.

The personal cognitive structure that underlies learning is the starting point in the development of absorptive capacity. Research on memory development suggests that accumulated prior knowledge increases the ability to add new and to recall knowledge. Cohen and Levinthal (Cohen & Levinthal, 1990) citing Hilgard (1981) suggested that “memory development is self-reinforcing in that the more objects, patterns, and concepts that are stored in memory, the more readily is new information about these constructs acquired and the more able is the individual in using them in a new setting” (Cohen & Levinthal, 1990). Further learning is also dependent on prior knowledge because memory building develops by associative learning. This means that the more categories prior knowledge is organized into and the more connections that are developed between these concepts, the easier sense can be developed out of new information. The type of prior

existing knowledge may also be a set of learning skills. By this extension the prior knowledge of learning skills may enhance the acquisition of new learning skills. As a result, prior knowledge is important for the concept of learning to learn. In the same way prior developed problem solving skills and heuristics increase the probability that individuals learn related skills. Cohen and Levinthal suggest that problem solving and learning capabilities share so much in common that these concepts do not need to be treated separately. The structural similarity of the two concepts differ only in the operational function where the learning capabilities relate to existing knowledge whereas problem solving skills relate more to the creation of new knowledge. From considerations of psychological literature analysis they conclude, that “creative capacity and what we call absorptive capacity are quite similar” (Cohen & Levinthal, 1990). To build absorptive capacity a short exposure to related prior concepts is not sufficient. The intensity of exposure is critical. Going back to psychological literature they suggest that prior related knowledge should be acquired with considerable effort and sufficient time should be employed in the learning activity. Due to the accumulative structure of learning and that learning is faster in areas where individuals already have existing prior knowledge.

For organizations to invest in the knowledge on sustainability is important. Only through this investment can increased proficiency be expected. This, however, is a known topic and certainly is enacted in institutions of higher education. On the other side, investment of resources like time and money in the building of learning skills and dynamic capabilities or continuous improvement in general might be considered in the same way as imperative.

The building of absorptive capacity is located within the individual. But this has to be organized by the organization. This leads us over to the organizational perspective that we will develop in the following subchapter.

2.6.2 Organizational Perspective

Learning in an organizational setting can be observed by the evaluation of learning curves. Research about learning curves root back to research in Psychology in late 1800s. This research focused on individuals and found that individuals required less time to perform a task and produced less error as they gained experience. In research of Thrustone

(1919) (in (Argote, 2005)) the progress of students in a typing course was observed. Later learning curves were also identified at an industrial level. Learning curves simply imply that learning has occurred; when the cumulative output coefficient is significant learning has occurred as productivity has changed as a result of experience. In the setting of environmental management systems the learning curves may be represented by changes in the environmental performance of the organization, or other adapted indicators. The changes are then typically observed in progress ratios. An 80% Progress ratio means that each time the cumulative output doubles costs declined 20%. It is important to notice that economy of scale factors can be statistically controlled. This expression of performance improvements through cumulated output in environmental management systems may be difficult. In universities the cost per graduated student ratio or cost as general may not be the eminent evaluation factor, neither would be the graduated / pollution factor be the perfect measurement. On the other side the reported environmental indicators mentioned above try to express exactly this progress or learning of the organization.

It is interesting to think about the areas or repositories where these increases or learning take place. A long history of psychological research supports the view that increased skills of individual workers are a key factor for organizational learning curves. In Argotes (Argote, 2005) research about franchises the pizza-tossing task showed important learning curves. To follow the above introduced terminology we would say that the improvement is located in personal skills. Modifications in technology are other sources where major contributions to productivity gains are observed as organizations gain experience. In the case of environmental management systems, increases in environmental performance that come from the use of different technologies is obvious (i.e. different extractors in chemical laboratories). The third major area where production increases were found is in structure and routines. In this case structure refers to the organization of the organization and routines for procedures.

It is interesting to notice that learning curves show tremendous variations. In research of Dutton and Thomas (1984) (in (Argote, 2005)) they found ratios as low as 55% and as high as 107% where an average range was found of between 81 to 82%. They found that the

ratios do not only vary between different industries but that the ratios sometimes show even more variation in organizations that produce the same product. There is no doubt that in a university setting the development of the environmental performance shows similar variations. The scope of this research concentrates on organizational systems or social systems aspects. Technological repositories are of minor interest.

2.6.2.1 Repositories of organizational Knowledge – organizational memory

When we consider organizational systems as purely operational systems that only exist in the present, and their organizational structure is only of importance in the present (when operations limit the connectivity of future operations), considerations on the function of memory are important. The memory of the organization is not only important on occasions, but it is used in the present in every operation. Argote (Argote, 2005) found different approaches where the question is, whether the individual is included as repository or not. We will follow the argument of Luhmann (Luhmann N. , 2006) that organizational memory without the inclusion of individual memory is difficult to imagine as this would require extremely good documentation. But as much information is context dependent and difficult to describe, the individual memory is a necessary knowledge repository for the organizational memory. The downside of the individual memory is that it is less reliable for the organization. Especially the tacit character or personal skills has certain importance. In the beginning it was thought that learning curves were cumulative in nature. This is also why the traditional learning curve uses cumulative output as proxy variable for organizational knowledge. But several case studies revealed that after a disruption of production unit costs were higher than they were before the interruption. Further research on organizational forgetting suggests that recent experience is a better predictor of current productivity than past experience. Practice is important to maintain skills. Consequently, research quoted by Argote showed that: “For organizations that make things, productivity improvements are generally embedded in three repositories: individual workers, organization’s technology, and its structure and routines. ... Individuals are capable of capturing and transferring subtle nuances and tacit knowledge. By contrast, organizational structures, and technologies are less sensitive repositories. Knowledge embedded in organizational structures and technologies, however, is more resistant to depreciation and

more readily transferred than knowledge embedded in individuals. Organizations can use the strengths of one knowledge repository to offset the weaknesses of another.” Environmental management systems like ISO 14000 or EMAS put special importance on documented procedures, audits, evidence and records in order to ensure that the memory of the organization that is used for every operation is in accordance with the predictions of the environmental management system.

2.6.2.2 Dynamic aspect of learning in organizations

The paradigm of organizations as systems that process information and solve problems, which are presented to the organization coming from its uncertain environment, characterizes the organization in a function of how efficiently it can deal with this information. This view limits the understanding of organizations to an “input-process-output scheme”. The paradigm restricts the understanding of organizations to a static view of processing while it does not recognize the dynamic aspect of what is created by the organization (Nonaka, 1994). In the innovation context and much less in the context of the implementation of environmental management systems the operation of an organization cannot be explained sufficiently by pure information processing. The definition or creation of the problem (especially universities were characterized as a collection of choices looking for problems (Cohen, March, & Olsen, 1972)) and the active development of new knowledge for the problem solving requires the development of a more dynamic view of the organization.

For the organization individual learning to some point is of minor interest. If people learn, not necessarily does the organization learn. It is the social aspect of learning, which is important for organizational learning. Nonaka differentiates four types of knowledge transformations (Nonaka, 1994):

- 1) from tacit knowledge to tacit knowledge: The key to this conversion mode is shared experience by interaction between individuals. Nonaka refers to this mode as “socialization”. In organizational theory this concept is related with organizational culture.

- 2) from explicit knowledge to explicit knowledge: This mode denominated “combination” refers to the reconfiguration of existing explicit knowledge by social interaction like in meetings or conversations. In organizational theory this dimension is rooted in information processing
- 3) from tacit knowledge to explicit knowledge: This concept is named “externalization”
- 4) from explicit knowledge to tacit knowledge: This transformation, that Nonaka calls “internalization” is related to the organizational learning.

Although each of the knowledge conversions can raise new knowledge, Nonaka sees the special use of his concept in a combination of the four transformations. “Knowledge creation centers on the building of both, tacit and explicit knowledge and, more importantly, on the interchange between these two aspects of knowledge through internalization and externalization” (Nonaka, 1994). The organizational knowledge creation process is different to the individual knowledge creation process. Through an organizational management of the knowledge creation process, the knowledge creation is coordinated in the form of a spiral. This spiral combines the dimension on one axis the organizational level going from the individual over to the groups and organizational level and may well pass the organizational system over to the wider social system. On the other axis, the change between the four above mentioned knowledge transformations are represented where the cycling of the spiral expresses the shift between the dimensions of explicit and tacit knowledge.

The first step of this spiral is represented when in a socialization process a team or what Nonaka calls “field”, is established. In the second “externalization” phase the field enables the team members to make explicit their implicit knowledge. In this phase Nonaka advocates the use of “dialogue” and the use of “metaphor” for the externalization of tacit knowledge. In the next stage, the information made explicit in the team can be recombined with existing explicit knowledge. Coordination between team members and documentation of existing knowledge are seen as methods in this stage- where an iterative process of trial and error creates an emergent concrete form of knowledge. The experimentation mode

triggers internalization in form of learning-by-doing back to tacit knowledge. As more and more people are involved with this process it advances to a higher organizational level.

The theoretical considerations of the model put into the organizational context can be described by:

- 1) *The enlargement of an Individual's Knowledge:* To enlarge the tacit knowledge of individuals variety of individual's experience and "high quality" of this experience is important. When individual experience is obtained in repetitive tasks the generation of tacit knowledge will decrease over time. The quality of this experience can be seen in the connectedness or the applicability – or how different experiences relate to one another. If the experience is not connected it is difficult for the individual to create new perspectives. Furthermore, Nonaka highlights the importance of bodily experience as determinant for the quality of experience. Nonaka denominates this "knowledge of experience". The concentration on tacit knowledge may lead to overemphasize action and efficiency and may restrict the search for higher-level concepts. To overcome this limitation "knowledge of rationality" – an explicit knowledge approach emphasized in western cultures, which favors the combination of explicit knowledge should be used in combination. In short: "Individual knowledge is enlarged through this interaction between experience and rationality, and crystallized into a unique perspective, original to an individual" (Nonaka, 1994).
- 2) *Sharing Tacit Knowledge and Conceptualization:* The widening of individual knowledge is important but stays within the individual. Only through social interaction the individual knowledge can enter the organizational context. Self-organizing teams are seen as a possibility for the creation of a field where tacit knowledge can be shared. As reality is socially constructed "individual behavior ought to be relativized through an interactive process to construct "social reality" (Nonaka, 1994). For self-organized teams to enable knowledge creation, redundancy is important. The understanding of members that build a self-managed team should not be restricted to the organizational boundaries but may include knowledge of the

environment. (Evolving communities as conceptualized by Brown and Duguid (1991) that “reflect the way in which people actually work as opposed to the formal job descriptions or task-related procedures that are specified by the organization (Nonaka, 1994)). “The self-organizing team triggers organizational knowledge creation through two processes. First, it facilitates the building of mutual trust among members, and accelerates creation of an implicit perspective shared by members as tacit knowledge. The key factor for this process is sharing experience among members. Second, the shared implicit perspective is conceptualized through continuous dialogue among members” (Nonaka, 1994). Mutual trust is a cornerstone in self-organizing teams that enables the members to co- experience through the sharing o individual experience. This enables the creation of a common perspective based on experience. In the concept of “learning by intrusion” redundancy permits the intrusion into the area of others and to give advice.

- 3) *Crystallization*: “The knowledge created in an interactive field by members of a self organized team has to be crystallized into some concrete form such as a product or a system. The central mode of knowledge conversion at this stage is internalization. Crystallization may then be seen as the process thorough which various departments within the organization test the reality and applicability of the concept created by the self-organizing team” (Nonaka, 1994).

- 4) *Justification and Quality of Knowledge*: “Justification is the process of final convergence and screening, which determines the extent to which the knowledge created within the organization is truly worthwhile for the organization and society. In this sense, justification determines the “quality” of the created knowledge and involves criteria of standards for judging truthfulness” (Nonaka, 1994). The criteria for judging the created knowledge has to be aligned with the higher order value system of the organization.

2.6.2.2.1 Team Learning

The social aspect of learning, the learning in a team is also addressed by Senge. The team learning discipline relies on the ability of a person to work on and improve both dialogue and discussion. For Senge “dialogue”, is the capacity of members of a team to suspend assumptions and enter into a genuine “thinking together”. Organizations are based on teams. Senge recognizes teams as the fundamental learning unit in organizations. “Unless teams can learn, the organization cannot learn” (Senge, 2006). Important for the definition of teams is that there is some degree of task interdependence, social psychological awareness and social embeddedness. Furthermore, groups are categorized as being relatively small. Accordingly Greenberg and Baron define a group as “a collection of two or more interacting individuals who maintain stable patterns of relationships, share common goals and perceive themselves as being a group.” (Greenberg & Baron, 2008). There is extensive research in social psychology that addresses aspects of team composition, behavior in teams, etc. This wide field of research cannot be reviewed for the scope of this thesis. However, as its implications for the organization of upheaval and convergence conditions in environmental management systems are important we will present a somewhat brief insight on the type of research that might be of interest.

2.6.2.2.1.1 *Sharing knowledge*

The different members of the group have distinctive knowledge bases. The knowledge of individuals is not automatically shared with the other group members – to share it the individuals need to remember the knowledge, perceive it as relevant, and they need to be motivated to share it with the other group members. Research on group-remembering, typically exposes group members to information that they are then asked to remember. In this line of research it was found that groups perform significantly better in remembering random items than their best member, although this was different for organized stories. When these collaborative groups were compared to nominal groups they still performed significantly better than their best individual but the total ratio of remembering was lower in the collaborative group ((Weldon & Bellinger 1997) in (Argote, 2005)). This lends to the sharing of information in groups. The sharing of information in groups occurs normally through interactions with group members. Argote quotes the interesting research of Strasser

where the conditions under which group members share their knowledge in these discussions is investigated. “The findings suggest that group members are more likely to share ideas that members already have in common than to discuss unshared ideas that are unique to individual members” (Argote, 2005).

The sharing of already known information may limit the potential of groups in order to access the variety of knowledge that resides in the group’s individual memories.

Groups with small amounts of information where the percentage of unshared information was high were more disposed to share their information with other members of the group (Strasser and Titus 1987).

In a short summary, research of information sharing revealed that:

- 1) Expert roles validate the credibility of unshared information (Steward and Strasser 1995)
- 2) People with more experience and expertise share more unshared information (Larson, Christensen, Abbot and Franz, 1996)
- 3) Larger groups focus more on shared information than smaller groups (Strasser, Taylor, and Hanna 1989)
- 4) The nature of the task influences the sharing of information. While consensus building in tasks where there was not obviously wrong or right answer inhibited sharing. Tasks with a digital answer promoted sharing of unshared information. (Strasser and Stewart 1992)
- 5) Social Loafing increases with increasing group size (Karau and Williams, 1993)
- 6) Sharing of unshared information increases with the duration of meetings (Fishman and Keys (1994)
- 7) Experience with the task surfaces more unshared information

Whether heterogeneous or homogeneous group members should compose groups has brought up inconclusive results. On a review of 40 years of empirical findings Williams

and O'Reilly (1998) concluded that diversity is more likely to have negative effects on group performance with the exception of diversity of backgrounds where this functional diversity had positive effects on group performance. They emphasize that a balance between the benefits of increased information brought through diverse group members has to be weighted against the costs of communication. Whether heterogeneous or homogeneous group members should compose groups also depends on the measure that underlies the success assumption. Heterogeneous groups seem to have an advantage when the diversity of knowledge is important to the group's task.

2.6.2.2.2 Knowledge generation

As seen above, in the rather theoretic considerations of Nonaka - not only do groups acquire knowledge by sharing individual members knowledge – they also generate new or emergent knowledge. The generation of new knowledge is especially important for groups when their task is related to innovation and creativity. In procedural approaches to knowledge generation procedures like brainstorming are empirically tested in order to perceive the benefits and problems these procedures show. Compositional approaches to knowledge generation focus on group composition and their effect on the generation of new knowledge.

2.6.2.2.3 Evaluation of Knowledge

Research showed that evaluation by a group is especially superior to individual evaluation of knowledge when the task includes knowledge embedded in hypothesis. While groups are not to be found superior to individuals in hypothesis generation they were found superior in hypothesis testing ((Laughling and Hollingshead, 1995) in (Argote, 2005)).

Groups are often brought about as expert teams with different backgrounds in order to generate new knowledge. In Strasser and colleagues 1995 research, mentioned above, results suggest that information sharing of real life groups increases with diversity of its members backgrounds. Whether a group can identify its internal expert properly is dependent on the availability of feedback to the group about their tasks result.

Several different research results underline that team experience improves their expert judgment. In general the knowledge of a group about who is good at what seems to improve group performance (Argote, 2005).

As mentioned above, research in this field is abundant and for the operational and capability building we strongly suggest further revision of this research stream.

2.6.2.3 Exploration and exploitation

A different classification of learning in organizations is the exploitation of existing competences, technologies and paradigms on one side (we are here in an area that is close to the above mentioned learning curves) and, the exploration into new alternatives on the other. Both types of learning are essential to organizations. Organizations that focus only on exploration are likely to face a situation where many new but undeveloped ideas are produced in the organization. On the other side, organizations that favour exploitation over exploration are likely to enter into suboptimal stable equilibria. In organizations these two learning modes compete for limited resources. Organizations consequently have got to decide on the allocation of resources for each learning mode. These decisions are made either explicit like in calculated decisions on alternative investments or implicit. Explicit decisions are deliberate choices of chosen strategies for resource allocation. Implicit choices are represented in a wide variety of organizational realities such as search rules and practices, decision schemes, reward schemes, ... The decisions on allocation are further complicated by the factors of time and certainty. The outcomes of exploitation are expected in a rather shorter time horizon and its outcomes are more predictable. Results of exploitation may be rather distant in time and can result in negative outcomes. As organizations learn from experience the allocation of resources either on exploration or exploitation has influences on the lessons learned. As feedback on exploitation is more direct than in exploration, the experience gained makes the outcomes of exploitation more certain. This may lead to a preference of exploitation over time. "Reason inhibits foolishness; learning and imitation inhibit experimentation" (March, 1991). The exploitation of an existing alternative may lead to an increased proficiency in an inferior procedure and inhibit exploration of new alternatives.

From the perspective of rational choice models several alternative decisions are available. All these alternative decisions have return probability curves that are unknown in the beginning. With the passage of time these return allocation curves are better known. Allocation of resources for exploitation means using the information currently available to optimize returns whereas allocation of resources for exploration means investment in the search of new alternatives.

In theories of limited rationality exploitation and exploration are typically seen in terms of targets or aspiration levels. When the alternative is above the expectation level further research into alternatives is inhibited whereas when the alternative is below the target level further search alternatives are encouraged. The adaptive character of aspirations is important for the discussion of alternative searches limited rationality theories.

From the organizational learning perspective exploitation is seen as improvements to an existing technology while exploration is understood as the invention of a new one. When explorational efforts are undertaken these slow down the exploitation of the existing technology while exploitation of the existing technology may make exploration efforts look unattractive.

From a systems point of view this is further complicated by the fact that as these decisions are found on the individual, organizational and the social system level.

For evolutionary models the exploration can be understood as the creation of variation whereas exploitation can be seen as an effective choice between them.

The social context of organizational learning and the trade off between exploration and exploitation has implications for individuals and organizations. Organizations store their knowledge in routines, technology, norms and rules. Individuals get socialized through the organizations and adapt to the organizational code – at the same time the organizational code adapts or learns from discrepancies of the individual to the code. There is an inherent

danger that individuals learn or adapt to the code before the code can learn from them. This danger increases in low turnover situations. In universities we can distinguish three groups or subcultures; students, administrative staff and professors. While administrative staff can be supposed to have rather low turnover rates, students rush in and out at a rather fixed speed. In-between can be seen the professors whom may also have a low turnover but there are programs of interchange and they have constant contact with other institutions. It could be possible to think to engage the fastest and less organizationally socialized group – the students - but it would also be important to bring them up to speed in a certain organized way in order to understand the organizational function. Explorational efforts here might easily be linked to thesis and project work.

3 Hypothesis

3.1 Conceptual approach to Environmental Change Management

As developed above, an organization that is interested in the implementation of an environmental management system has to build the capability of an operation with an especially good environmental performance. In line with the idea of continuous improvement the organization has to build a dynamic capability that reconfigures the organizational zero level operation. In this context, considerations of learning and organizational learning have explanatory potential.

Furthermore, the sequential and spatial considerations in the development of the environmental management system in height, width and development dimension require the environmental management team or steering committee to build out a zero level capability which operation mode is the reconfiguration of the organizational configuration. This capability is a dynamic capability on the organizational level. In addition, the development of this capability also requires an aspect of learning in order to enable an improvement in the departmental capability. In other words an aspect of reconfiguration or a dynamic capability connected with learning is also supposed to be of importance for the capabilities in the steering committee.

The following model expresses the developed model:

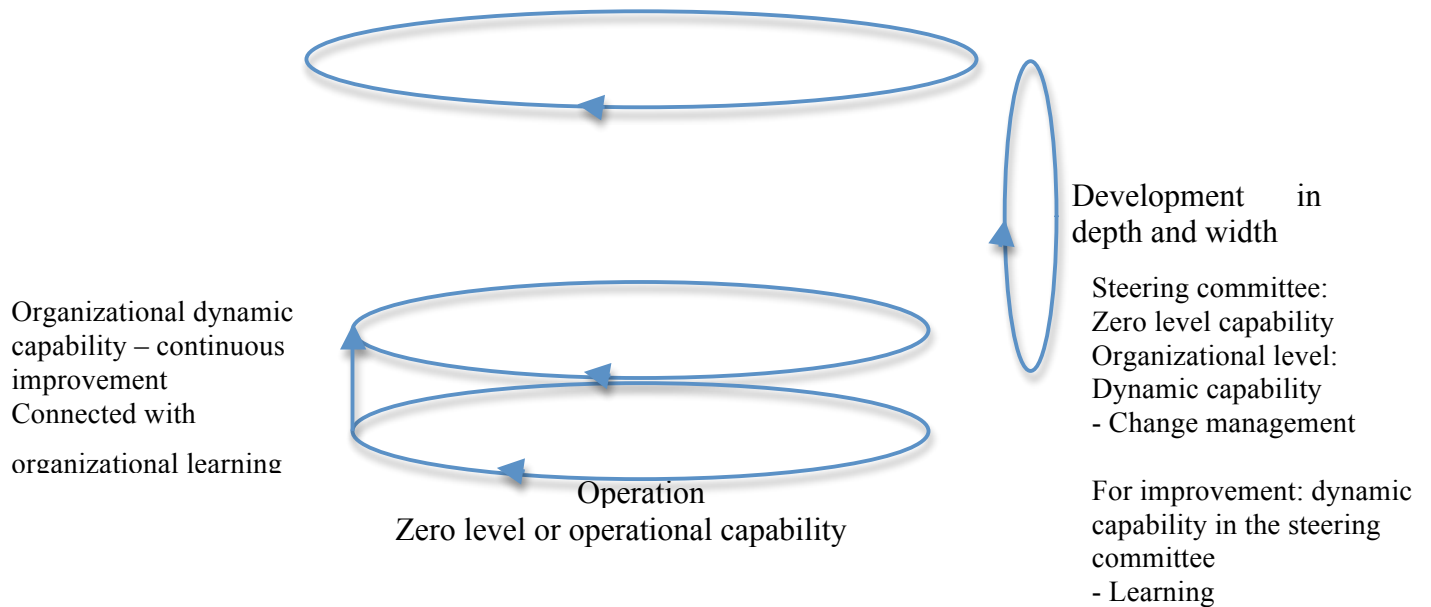


Figure 6: capabilities for improvement in environmental management systems (own elaboration)

3.2 Hypothesis

Out of the above-developed model we propose the following hypothesis:

First: In the development of environmental management systems the building of organizational capabilities and dynamic capabilities can be observed.

Second: The spatial separation and time consumption and the resulting sequencibility opens to two analytical levels: the organizational and the departmental level.

Third: The concepts of convergence and upheaval – or change management and learning have explicatory value for implementation efficiency and effectiveness.

3.3 Research questions

The research questions focus on the model developed above. We will make a distinction between the operational level of the organization and the operational level of the steering committee.

- On the operational level of the organization the first research question is if we can find evidence of organizational capabilities that are influenced by environmental aspects.
- The second research question is if we can find instances of learning on an operational level.
- On the departmental level in the steering committee our third research question will focus on zero level capabilities of aspects on change management.
- The fourth research question will focus on dynamic capabilities in the steering committee or aspects of convergence and learning.

4 Methodology

For organizational diagnosis there exist numerous options. We will understand organizational diagnosis as “a planned and systematic approach for gathering information about the internal state of an organization” (Doppler & Lauterburg, 2002). The planned and systematic approach for data retrieval that later allows the generation of information about the organizational system depends on the kind of information we want to generate. In this sense the method of collection is the mean to the end of information generation.

4.1 Secondary data analysis

In both standards EMAS an ISO 14000 the organizational memory represents an operational aspect that is represented by documented procedures or standard operation procedures on one side and evidence of operational performance and occurrences in the past that are represented by organizational records. In the explicit organizational memory these aspects should be treated. Evidence, on secondary data, based document review that concentrates on the explicit organizational memory should give information on the explicit structure of the environmental management system.

4.2 Primary data retrieval and analysis

As the operational aspects of implementation are not explicitly marked in the environmental management standards, a documental review may not render the required insight. As documentation of these aspects is not required it is possible they are not documented. Further we expect that the capabilities and dynamic capabilities in the steering committee are an important degree implicit. Because of this we will rely on methods for primary data generation.

4.2.1 Target Group

The question whom to include in the sample also depends of the data required. Generally the question who the repositories of knowledge are, defines who is to be included into the sample group. In the case of organizational analysis, hierarchical considerations come into play. On the higher organizational level there is a perception of what is working well and where problematic areas are. On the level of middle and lower management the view is different. The problems that are visible and known on this level are much more operational then they are on the higher level. On the operational level the problems and interactions might be most direct but the people generally lack on knowledge in leading organizational and strategic functions (Doppler & Lauterburg, 2002).

4.2.2 Sample

There exist basically two options to determine the sample size and method. First there exist the option of full sampling. The advantage of a full sample is not only to have a inclusion of a broad data basis but that all employees are included and individually participate. As with the words of Schein (Schein, 2003) any interaction has got to be understood as an intervention the way of data acquisition cannot be understood solely as the act of data retrieval but as an intervention that also sends signals. And from this point of view a full sampling is preferable (Doppler & Lauterburg, 2002). On the other side, if the organizational entity is huge the inclusion of all employees is impossible from a resource (money and time) point of view.

We decided to execute 12 interviews where two were executed in the Environmental Management Systems Coordination, four with representatives of the academic entities (random choice) and six with module leaders.

4.2.3 Method

The resources required for primary data acquisition is a function of at least two variables:

Resources required = f (personal interaction level, sample size)

On one extreme there are methods and scales using written sample tools and standardized questionnaires. The personal interaction in this case is low and the sample size by this can be chosen bigger. These tools have special advantages in the case of longitudinal organizational research and in the possibility of the application of statistical methods (i.e. correlation studies).

On the other extreme there is the personal interview. In this case the personal interaction is high and the sample size normally is reduced. While quantitative methods are preferred because of considerations of repeatability and significance from the scientific community, qualitative methods are preferred tools from the practitioner's side (Doppler & Lauterburg, 2002).

Between these two extremes there is a huge set of tools like diagnosis workshops, hearings and group interviews.

The critique from the scientific community on qualitative research centers on the argumentation that the outcome is not much more than story telling and case-by-case anecdotes that may have explicatory - but fall short on predictive value.

The practitioner on the other side values the sensibility and accuracy over the higher expenses of direct and interactive methods for primary data acquisition and favors interactive tools over static questionnaires (Doppler & Lauterburg, 2002).

These research questions center on tacit and explicit knowledge that lies in the environmental steering committee or management group. The group composition by that definition will include the members of the steering committee. The composition of the environmental management group is likely to represent mid level and higher level management with some participation of lower level or operational personnel.

Taking into consideration the partial tacit character of the data that is to be collected personnel interactive methods offer certain advantages. Further the steering committee is likely to represent a rather limited organizational size so that besides the elevated time resource consumption a good coverage can be reached. There exist special tools and methods to surface tacit components like cognitive mapping, conversational analysis or pattern recognition. However, as we do not possess experience in the usage of special diagnosis tools, for the scope of this research we will suggest and employ the use of semi-structured interviews. The semi – structured interview were recorded for further analysis.

5 Case and findings

Today, the Autonomous University of San Luis Potosí - UASLP includes 32,000 people and offers 65 different graduate courses. About 20,000 students study in 13 different faculties and schools. The University offers 70 postgraduate courses of which 36 are included in the national register for quality postgraduate programs. In these 70 postgraduate courses about 1,800 students are enrolled. About 600 professors are working full time, 135 half-time and in total there are about 2,700 professors involve in education, further the university counts about 1,900 employees. The major installations of the University are located within the state capital but there are 2 further regional campus included into the physical structure of the UASLP (UASLP, 2010).

5.1 Implementation History

In the late 1980s and beginning 1990s the society increasingly requested from the UASLP services related to ecological and environmental issues like research, training, laboratory services and specialized consulting. In the sense of requisite variety the

organization had a structural response with the creation of the “Comisión de Medio Ambiente” (Environmental Commission). This commission was established in 1992 by the principal. This commission had special participation of the faculties of Engineering, Medicine, Chemical Sciences and Habitat. After 6 years of operation the commission presented a project to (Nieto Caraveo, 1998):

- Integrate environmental aspects in the university through the participation of the three integrants of the community of the university: students, professors and staff
- Constitute environmental programs that include different academic groups execute in different faculties, institutes and schools
- Increase organizational structures and mechanisms in order facilitate collaboration between different work groups
- Increase the impact of the environmental programs within the university
- To bear the challenge of interdisciplinary through the social construction of knowledge around concrete working objects

In 1998 the principle accepted this project and instructed to build the “Coordination of Environmental Programs”.

5.2 Agenda Ambiental

The coordination of environmental programs led and developed to a special office that reports to the principal. Following the ideas that were developed by the environmental commission the now institutionalized office – the Agenda Ambiental (Environmental Agenda) “whose mission is to promote and support inclusion of the environmental and sustainability perspective in every university endeavor, in such a way as to have a profound impact to the inside and to the outside of the institution” (UASLP, Agenda Ambiental de la UASLP, 2004). The Agenda Ambiental is a small office that is staffed by few administrative employees but relies also on the participation of social service students, promoters, and the collaboration of professors and authorities of the UASLP (UASLP, Agenda Ambiental de la UASLP, 2004).

The specific objectives of the Agenda Ambiental are to contribute to (UASLP, Agenda Ambiental de la UASLP, 2004):

- Incorporate the environmental perspective to grad and undergrad curricula
- Form and update the professors and researchers in environmental, ecological and sustainable development topics
- Strengthen research, grad studies and applied studies
- Diversifying of technical laboratory services, consulting and field studies.
- Increase the environmental and sustainability performance of the university itself in energy and water consumption, residues, effluents, paper, vegetation, landscape, etc.
- Develop innovative strategies of environmental communication.

The Agenda Ambiental defines their main challenges as follows (UASLP, Agenda Ambiental de la UASLP, 2004):

- To articulate environmental programs being developed by diverse academic groups in faculties, schools and institutes.
- To contribute to institutionalizing of collaborative and transversal work mechanisms among academic entities and groups inside UASLP
- To generate a major intra and interinstitutional impact and transcendence for environmental academic programs of UASLP
- Build the interdisciplinary aspects around concrete work objects.

The activities of the Agenda Ambiental are formally organized in different types of programs. According to their character, the activities are divided into specialized, strategic or special programs. The successful work of the Agenda Ambiental resulted in the UASLP winning the national price for ecological merits in 2006.

5.2.1 Special Programs

Special programs are activities that can be summarized as outreach programs. These programs are oriented towards the wider social environment of the university and have

impact on a local, regional and national level. They are concerned with environmental aspects and due to the multidisciplinary character, these projects are under the coordination of the Agenda Ambiental. They are projects contracted by external entities (UASLP, Agenda Ambiental de la UASLP, 2004).

5.2.2 Specialized Programs

Specialized programs are under the responsibility of faculties, schools and institutes and other academic entities. The Agenda Ambiental supports these programs with expertise and focusing on environmental and sustainability aspects within these projects (i.e. aspects of graduate programs, postgraduate programs, research, laboratories, service and consulting) (UASLP, Agenda Ambiental de la UASLP, 2004).

5.2.3 Strategic Programs

The strategic programs are under the responsibility of the Agenda Ambiental. They have an ongoing and not project based character. At the moment the Agenda Ambiental has three strategic programs: Postgraduate Multidisciplinary Studies Program (PMPCA), the University Academy for Environmental Sciences (AUMA) and the Environment Environmental Management System (EMS) (UASLP, Agenda Ambiental de la UASLP, 2004).

5.2.3.1 PMPCA

As the Graduate Multidisciplinary Studies Program in Environmental Sciences (PMPCA in its Spanish acronym) is the first graduate program that was offered at the UASLP in a joint effort by several academic entities, it was a special administrative success of the Agenda Ambiental. The PMPCA is created under the responsibility of three faculties (UASLP, Agenda Ambiental de la UASLP, 2004):

- Chemical Sciences
- Medicine
- Engineering

The other following 5 entities participate in the program (UASLP, Agenda Ambiental de la UASLP, 2004):

- The Desertic Zones Research Institute
- The Institute of Metallurgy
- The Coordination of Social Sciences and Humanities
- The Faculty of Agronomy
- The Faculty of Habitat

The PMPCA is a university program that offers graduate and postgraduate courses at the masters or doctoral level. It focuses on the development of human resources in a multidisciplinary field that have employability in environmental aspects on a regional, national, and international level. The program includes five different research areas:

- Prevention and Control
- Environmental Assessment
- Natural Renewable Resources
- Environmental Management and Policies
- Environmental Toxicology.

The PMPCA is accredited by the National Program to strengthen Graduate Studies (Pifop) of National Council of Science and Technology (CONACyT).

5.2.3.2 AUMA

The second strategic program of the Agenda Ambiental is the University Academy for the Environment (AUMA in its Spanish acronym). It was created in the beginning of 2003. Professors of the UASLP that are interested in integrating environmental aspects and sustainable development into their programs and courses find help with the design and practice of educational and didactic material within the AUMA program. Its mission is to contribute to the improvement of education through the generation of physical and virtual spaces for reflection, conceptualization, self assessment and follow up of professors'

projects in all diverse disciplines and matters related to environmental and sustainability aspects. Full time and part time professors, and technicians form the academy. It is presided by the Rector of the University (UASLP, Agenda Ambiental de la UASLP, 2004).

5.2.3.3 SMA

The third strategic program of the Agenda Ambiental is the Environmental Management System (SMA for its initials in Spanish). The environmental management system was created between 2000 and 2002.

Important aspects of the setup of the Agenda Ambiental and of their work within the university focus on the above mentioned strategic, special, and specialized programs. Within the scope of this we will focus on the environmental management system – SMA where our special attention is on strategic management.

“The purpose of SMA is to avoid or diminish adverse environmental impact in the functioning of UASLP and constitute a model of environmental quality projected towards the institutional surrounding” (UASLP, Agenda Ambiental de la UASLP, 2004).

We proposed that a spatial separation and two different levels for analysis would emerge. The Agenda Ambiental represents a spatial separation in conformity to our model.

5.3 Environmental Management Systems Steering Committee

Above we have developed considerations on the necessity to create, respond or manage convergence and upheaval conditions and aspects of change management and learning. We now again change the perspective and have a look into the organizational setting and the question of structure.

5.3.1 Top Management

In EMAS and ISO the support from the top management is mandatory. Without the inclusion and support of the top management, success and acceptance of the environmental management system in the organization is unlikely. The classic considerations of Machiavelli might underline these considerations (Machiavelli, 1990). Also Luhmanns line

of argument that hierarchical structure is used in cases of arbitration supports this position (Luhmann N. , 2006). In the case of UASLP the Agenda Ambiental was created by and reports to the principal office. Within EMAS top management has to provide the necessary monetary and personnel resources for implementation and operation. Furthermore, it has to announce a responsible person for the environmental management system.

5.3.2 Representative of the Top Management

The coordinator of the Agenda Ambiental is responsible for the development and inclusion of environmental and sustainability aspects into the endeavors of the UASLP. He reports to the principal on a regular basis what is in line with EMAS and ISO requirements (about every 6 months (Morales Ávalos, Medellín Milan, & Nieto Caraveo, 2008)). As seen above the Agenda Ambiental includes different aspects and projects and the environmental management system and the coordinator of the Agenda Ambiental presides all these programs.

For operational aspects of the implementation of an environmental management system into institutions of higher education it is usual that the representative of the EMS System assigns an environmental management assistant (or a group of persons). This position is responsible for: the project coordination, the recompilation of project results, leading the environmental management group, reviewing the environmental aspects of the organization, elaboration of the environmental review, planning of environmental audits, creation and maintenance of the environmental program, reporting to the representative of the top management and the top management on a regular basis, the updated legal register and responsible for a regular information towards employees and students (Strauß, 2005). The UASLP follows the same strategy. This assistant position was updated about 2 years ago, dedicates about 50% to the development of the EMS and depends on the coordinator of the Agenda Ambiental.

5.3.3 Environmental Management System Work Team

The coordinator of the environmental management system cannot create and implement the environmental management system on his own. He requires a working team that assists

him in the implementation process. Earlier, we referred to this as the steering committee of environmental management system.

As the environmental management system targets environmental and sustainability issues, expertise in this area is required. To guarantee the expertise the UASLP has created special thematic modules.

Furthermore, as the environmental and sustainability aspects should be included in all endeavors of the university representatives of the different schools and faculties are also represented.

5.3.3.1 Expert Teams – Module Leaders

The UASLP has decided to create 12 different special topic modules. Each module has a leader that is chosen due to their knowledge in the specific module topic. The knowledge areas that build the modules are:

1. Handling of Regulated Substances and Materials
2. Complying on Emissions, Discharges and Residues
3. Appropriate and Efficient Use of Energy
4. Appropriate and Efficient Use of Water
5. Appropriate and Efficient Use of Office Supplies
6. Administration and Acquisitions
7. Revegetation and Landscape Architecture
8. Bioclimatics and Construction
9. Risk and Contingencies
10. Maintenance
11. Norms, Standards and Certification.
12. Communication and Education.

5.3.3.2 Representatives of Faculties and Schools

Each faculty or school formally names a representative as contact for the environmental management system. This representative should have an interest in environmental and sustainability issues and have acceptance within the faculty. The group of environmental management system representatives includes 26 people.

5.3.3.3 Faculty Leaders

In organizations of higher education the principle of freedom of research and teaching has led to the development of rather independent faculties and schools. Following Karl Weick (Weick K. E., 1976) we can see universities as loosely coupled systems. Complex systems may be decomposed into more or less stable elements or subsystems. The question if these elements are stable elements or dynamically generated through usage and memory reproduced structures in the sense of Luhmann, or capabilities, is not of importance at this point. Subsystems like the principal – vice principal – superintendent system and the teacher – classroom – pupil – parent – curriculum system or faculties and schools exist within the same organizational system but the reelection of the principal does not have direct repercussions in a certain curriculum. Loose coupling permits the systems not to have to respond to every change in the environment. The concept of autonomous universities may correspond to this desired inertia. Furthermore, loosely coupled systems may possess more subsystems that can be distinguished and that may offer the organization more sensing instruments for the environment. This may be important for the detection of developments of the faculties and schools in their specific field and as a consequence, local adaptation and response. Additional considerations are breakdown conditions. In a breakdown or critical situation of one subsystem, loose coupling may prevent a spread over the whole system. Examples may be declining productivity, loss importance or reputation of one specific career, which does not need to have repercussions in other disciplines.

Although these considerations may be seen as desirable and may explain why organizations of higher education show these elements - they are also important for considerations of environmental management systems implementation in this type of organization. The perseverance that loose coupling gives to the organization may also

inhibit desirable adaption, desirable standardization may be inhibited, successful adaption may not spread over the system and unsound subsystems may show to be difficult to cure. When planning change initiatives we should consider these circumstances.

The setup of the environmental management system of the UASLP, with the creation and integration of the different faculties reflects these considerations. For the operation, the focus may fall on coupling elements. These coupling elements may be technical connections like authority and programming. In a loosely coupled system like a university, creating an environmental management system can hardly be executed in a centralized way because there is no direct line of authority and there are not many programmed interactions between the different subsystems.

The role of the deans and faculty leaders in this understanding is to copy the idea of top management and responsible coordinator down into the subsystems with the dean / faculty leader to a named environmental management system representative. The inclusion of the faculty leader represents the subsystem hierarchical integration and secures favorable conflict resolution. We could characterize the role of the deans or faculty leaders as enabler.

5.3.3.4 Responsible of the auditable unit

The environmental management system of the UASLP puts its focus on auditable units. When the organizational subsystem is in operation and uses or produces outputs that are subject to one of the 12 environmental management modules it may be defined as an auditable unit. In the first module, management of regulated materials, all areas and activities where regulated materials are used are defined as auditable units. The same applies for the second module (emissions and discharge) for outputs. This separation of process and outcome is also relevant in module eight on bioclimatic and constructions. The auditable units must be able to be observed as separated systems (like branches of the water distribution system in module three). This enables causal attribution like in the fourth module on efficient energy use, where the integration several subsystems is required for a single building. From the causal attribution responsibilities also can be derived and reflected in organizational positions.

We may characterize the auditable unit as an atomization of the organizational system into subsystems which operation and output concern one of the environmental management systems modules and where the integration towards causal attribution can be connected with organizational positions.

The responsible people of these auditable units are of course the contact persons, organizational or communicational contacts for the steering committee of the management system. Within the language of the environmental management system, these persons are named responsible auditors.

The atomization and observation requires resources. Integration may jeopardize detail. From an economic view a balance of detail and cost may be important in the definition of the auditable units as well.

5.3.4 Staff and Students

From the revision of the organizational memory we found clear evidence that the operational staff are the change targets for operational purposes and the environmental management system here is comparable to ISO considerations.

In line with the principle of the inclusion of all members of the university students are also included into the development of the environmental management system i.e. in the scope of projects, thesis work, research etc.

5.4 Organizational capabilities

5.4.1 Organizational capabilities – operation

If we follow Teece, Pisano and Shuen (Teece, Pisano, & Shuen, 1997) and put our focus on competences and capabilities that can be molded into a variety of products, operations that have effect on environmental performance of the organization can be understood as zero level organizational capability (Winter, 2003). This means the capacity of the organization to have a certain environmental performance. From system theoretic considerations (Luhmann N. , 2006) we can see zero level organizational capabilities as the

existing organizational structure with its decision premises in persons, positions, conditional programs, ends oriented programs. This existing organizational structure operates in the present and relies on organizational memory that we find in the individuals, files, technology and physical structure (Argote, 2005).

Following Argotes considerations of learning curves (Argote, 2005) and system theoretic considerations of operation (Luhmann N. , 2006) (Luhmann N. , 2009) (Simon F. B., 2008) (Simon, 2007) we can see that the organizational capabilities are not the accumulation of all acquired organizational knowledge over time, but it is more the accumulation of organizational capabilities minus organizational forgetting.

With these considerations we see that the organizational capability of the organization is its actual state in the depth, width and development dimension (Gastel, 2005).

The Agenda Ambiental has generated important organizational structure since its foundation, to name only a few we can refer to the existence of the Agenda Ambiental as a department and its own decision premises, the communication paths that have been developed and are in use in the present, microanalysis in chemical laboratories, recycling of controlled dangerous substances, structure to respond to accidents and contingencies, programs for battery-, paper-, printer cartridges-, and electronic scrap recycling, ...

Out of our hypothesis we have developed the necessity of organizational structure. This organizational structure can be observed and is also oriented towards the improvement of the environmental performance of the organization.

Organizational learning mechanisms on the operational level that we proposed did not enter the explicit organizational memory. Taking into consideration the development of the environmental management system we would expect to be able to locate and describe these mechanisms – but as we have mentioned in our methodology we did not apply methods to surface tacit organizational capabilities or routines. In this point we were not able to verify the value of the model.

To follow our model, the existence of organizational structure that is oriented towards the environmental performance of the organization, we should also find dynamic capabilities that result in the generation of this structure.

5.4.2 Steering committee capabilities – change or upheaval

5.4.2.1 Organizational perspective: Continuous improvement – PDCA –Cycle

In the creation phase, where documents date back to 2003, (Medellín Milán, Las Universidades Frente al Desafío de la Sustentabilidad, 2008) of the environmental management system at the UASLP an analysis of the most significant environmental aspects was executed. This analysis is a qualitative analysis where the problematic or significant environmental aspects were assessed in terms of weak, important and urgent problems for the university in relation to the environmental aspects. The qualitative aspect was chosen mainly because the university did not possess the necessary infrastructure such as measuring devices and not the knowledge about the physical infrastructure of the university (Medellín Milán & Nieto Caraveo, 2010).

The environmental management system is projected to be composed of three main elements (UASLP, Agenda Ambiental de la UASLP, 2004):

- Environmental Audit: “Analyzes the performance of the university in relation to a model that is composed though indicators and their specific criteria”
- Environmental Management Plan: This “is a document that establishes the mission, vision, objectives and politics as well as the programs that allow the development the issues treated in the environmental audit document”
- Performance Indicators: “Are a tools for the evaluation of the environmental performance of the university in the context of sustainability. They indicate the variation of performance and specifies standards”

The environmental audit is comparable with the process for the development of the environmental statement. This is the creation of data that is converted into information

through the communication of indicators. This complies with the environmental performance aspect of the environmental management system. The second function; the aspect of compliance is not included in this consideration.

The environmental management plan can be understood as a combination of the environmental policy, the environmental objectives and the environmental program. This sequence follows the baseline or is comparable to the EMAS standard described above.

The performance indicators show, with the inclusion of a development function over time, the tendency of the organization. This also is comparable with the EMAS standard.

EMAS sees in the environmental review the starting point for the development of the environmental management system. From this initial assessment the significant environmental aspects are derived. Out of this analysis the environmental accounts and environmental accountability are developed. In analogy to process engineering we can compare the environmental review, which prepares the environmental management accounts and the development of the environmental policy, with an upstream process and the development from the environmental policy to the environmental objectives, targets and program with a downstream process.

If we follow Eisenhardt and Martin (Eisenhardt & Martin, 2000) and see the organization as bundles of resources and Teece, Pisano and Shuen (Teece, Pisano, & Shuen, 1997) separate resources in tangible and intangible assets. We can see that the operational state requires organizational and physical structure and organizational structure. The environmental management system of the UASLP is in the phase where necessary tangible structure is built that in a later state allows this development.

5.4.2.2 Departmental perspective

For the development of organizational structure the environmental management system relies mainly on the work of the module leaders whose role it is to develop the module handbook and with this, the special methodology we have reviewed above. The module

leaders are professors with experience in the field of the module. They normally develop steps or projects with the help of thesis works and projects together with students. For this access they need to develop a constellation of topic, interested professor, interested students and possible funding of the project.

Each module has a core document that specifies the general objective, specific objectives, and criteria of operation, general methodology, specific methodology and specific actions. Not all modules have the same progress in the development of this handbook.

For our analysis we will use the handbook of module one on Handling of Regulated Substances and Materials as it was found to have reached the highest degree of specification.

The general objective corresponds to the environmental objective in EMAS and represents the overall environmental goal of the module.

This general objective is broken down to specific objectives. These specific objectives are not quantified, as the standard would require.

The nature of the criteria that are specified in some, not all, module descriptions remains unclear. We could imagine that for the development of the means that are developed out of the specific objectives, these criteria should be met in order to limit, out of the population of possible means, means that are acceptable for the organization. This would locate the criteria on the side of planning. Another understanding of this criteria could be on the side of control, where the criteria represent the environmental management system's individual measures that are included into the indicators. At this stage however the function of this criteria is unclear (unknown, no date) (Morales Ávalos, Medellín Milan, & Nieto Caraveo, 2008).

The general methodology is parallel to the means of the environmental program in EMAS although not quantified, dated and connected with responsibilities.

We will have a closer look at the characteristics of the specific methodology as we have detected an amalgam of very important and specific aspects that we will try to develop and classify further. The specific methodology includes (unknown, no date):

- Personnel that should be included in training activities (i.e. warehouse clerks, responsible for residues, personnel of hygiene and security, ...)
- Specification of training needs (i.e. new employees)
- Positions that are to be created (i.e. responsible for residues, ...)
- Description of position requirements (i.e. extended knowledge in chemistry,...)
- Responsibilities of the positions (i.e. periodic inspections)
- Need for documented procedures (i.e. handbook for auditable unit)
- Specific required procedures (i.e. control of labels)
- Generation of evidence (i.e. register for disposure)
- Requirement for initial inspection (i.e. personnel, location, ...)
- Topics of the initial inspection (i.e. what kind of processes, what chemicals, ...)
- Communication paths
- Inclusion of existing structures (i.e. commission for hygiene and security)
- Maintenance of the system (i.e. periodic control of registers)

In the terminology that we have introduced above we would call the specific methodology a dynamic capability on the organizational level or a zero level capability for the level of the steering committee. If we consider 26 academic entities with numerous laboratories and an important number of practices that are developed in these laboratories we see that the change that is to be introduced can be expected to occur in a repetitive way. Each entity can be expected to be different, each individual practice will be different and the outcome of the implementation will take different forms (i.e. manuals,...) but the successful application in one case is robust enough to apply it in different settings and occasions.

In our model we proposed that organizational dynamic capabilities should be found in an organization where environmental management systems are being implemented. The case of the environmental management system of the Autonomous University of San Luis Potosi corresponds to our model.

5.4.3 Steering committee capabilities – learning

The most salient information from the interviews was, and every representative of the faculties and every leader of the module has mentioned and referred to the point, that they felt a lack of interchange. The module leaders expressed that they do not have contact with other module leaders. In the same way the representatives of the faculties that were interviewed expressed that they do not have connections with other faculty representatives. It may be a consequence of this perceived missing interaction that several interviewees characterized the different programs and actions that exist as isolated and not connected.

Also, in this case, learning in the steering committee is not reflected in the explicit organizational memory. The fact that we were able to locate emerged dynamic capabilities might be understood as a result of learning, but also in this case, as we have not applied methods to surface tacit structures and routines we cannot affirm or negate our model on this point.

6 Interpretation

6.1 Capabilities in convergence – or learning

6.1.1 Observation and learning

Learning from a psychological point of view is seen as a relatively stable change of behavior of an organism due to experience. In associative learning, organisms learn to connect certain events (Myer, 2008). In classic conditioning, the organism connects two different stimuli that are not under his control (and following Polanyi (Polanyi, 1966) the organism even might not be consciously aware of the connection what would then be tacit knowledge) whereas in operant conditioning the organisms learn to connect a certain

behavior, that is under the organism control, with positive or negative amplifiers. Furthermore in observational learning the organisms learn by the observation of others through modeling (Myer, 2008).

We could characterize this, maybe with important simplifications as the attribution of causality of a sense processing system. Important for this subchapter is that prior to the cognitive treatment of data and the generation of information there has to be an observation. For learning to be able to develop we need to observe in the first place. We need an observer that observes. Following from analytic considerations we would say that the observer first has to make a distinction of himself and the system he observes. Luhmann (Luhmann N. , 2009) asks the question of how the world would observe itself and answers in the sense of von Foerster and Spencer Brown that the world would produce physicians, which then would observe the world. Again we might oversimplify but I consider it possible to say that the system (here: the world) develops an operational observer (here: the physician) that differentiates himself from the world and makes it observable. The system operates and generates a system that operates and through this operation observes the system. The result is a first order observation. The system observes itself. In a next step we could think of another observer that observes the observer, in our example an observer that observes the physician. In second order observation we limit our view of the world to only one observer. We make the distinction of this observer and all the other observers, the physician and all the others. From this limitation of the world we get the world back through the observations of the observer. We go from the reduction of complexity to the creation of complexity. We see how the physician sees the world. He does not see the world as it is, but as what he gets indicated by its instruments. The distinction he makes in the distinction is invisible for the first order observer but can be seen by the second order observer. Following Luhmann (Luhmann N. , 2009) we can say in terms of Heinz von Foerster that the first order observer has a blind spot.

Administrative science is conscious of this problem and in order to live with the blind spot problem, tools like 360° feedback are used to represent a system indexed by different observers (the perception of the environmental management system seen from the

perspective of students, professors, administrative staff, the society, other universities, etc.). The very core of administration that goes back to Henri Fayol, the administrative cycle, with its planning, organizing, direction and control, has the observational aspect included. But also for the topic of environmental management systems, the idea of continuous improvement with its Plan – Do – Check - Act Cycle has with the checking, an aspect of observation. In nearly all subchapters described above, the first step starts with an observation. From a system theoretic point of view in this case we are not in the area of instruction and controlling but in the intentional creation of an observer within the system.

We have different requirements for convergence and upheaval conditions or for change management and learning. Organizational learning, that is characterized by unintentional, emergent changes, which from an evolutionistic point of view can be seen as variations that are subject to selection and retention is different to the planned, intentional, rational or system rational access of change management. In the former the observer has to be seen in connection with the selection a retention process whereas in the latter the observer targets the means ends development. In the case of learning, the critique might be the question how manageable evolution is at all and in the case of rational planning the question might be how rational an organization really is.

In planned change projects we want to reach certain ends. These ends are operationalized through the development of certain goals. Observation requires distinction. The goal can be made observable through the connection of the goal with a value that can be met or not met. The form of goal attainment makes the goal observable through the distinction of achieving the value or not. This simplifies or maybe oversimplifies the organization. The organization is observed as a uniform existence. That it is in fact a different organization depending on the point of view is easily forgotten. There is also a distinction within the goal. Different observers might have different distinctions and different perceptions of the goal.

Judging the reached goal as successful also depends on the observation. With the observation we generate data. This data in a sense of monitoring can be expressed in

indicators. This data needs to be interpreted to turn it into information to enter communication.

The idea of continuous improvement has an implicit time dimension. The future of the operational state of the system should be better than the present. The question that arises from this consideration is how much better should it be and until when? How should we generate this improvement? Who is responsible for it? To a certain degree we go back to considerations of the environmental program from the second chapter that by means ends considerations connect with the environmental targets and the environmental policy. From system analytic considerations on the time frame we introduce the possibility of observation into the system. If we again see observation as a difference we introduce the difference of complying with the date or with not complying with it. This difference can be observed by the system and it can be converted into information that can be part of the conversation of the system. Making a task observable by connecting it with a due date is not a neutral value. Research in project management and scheduling found a typical development in the development in attaining set dates. Research has shown that after half of the time, that was available for the task completion has passed, has passed typically a re-evaluation of the achieved progress and the scheduled goal is executed that results in increased efforts and dedication in the second phase (Greenberg & Baron, 2008). Setting goals and making them observable have the effect of increasing its importance as the programmed date comes nearer. From a practitioner's point of view, Sirking, Keenen and Jackson found that:

“Scheduling milestones and assessing their impact are the best way by which executives can review the execution of projects, identify gaps, and spot new risks. The most effective milestones are those that describe major actions or achievements rather than day-to-day activities. They must enable senior executives and project sponsors to confirm that the project has made progress since the last review took place” (Sirkin, Keenen, & Jackson, 2005).

Also in the context of environmental management systems implementation, universities of higher education in connection with the scheduling, sometimes with the help of project plans like at Mälardalen University (von Oelreich, 2004) or the University of British Columbia have shown to be effective. Connection of the environmental program with dates and responsibilities in EMAS goes in the same direction and it is explicitly shown in the handbook for EMAS implementation for German Universities (Strauß, 2005).

In order to learn, we have to observe, and observation is not neutral. It makes certain things observable and hides other. We consider it of special importance in the development phase as in the case of the environmental management system at the UASLP. In the sense of evaluation (Krahn, Neus, & Rietz, 2007) we have to decide what we observe and what not. In the stage of structure creation the observer has to be created and considerations on cognition and the attribution of what is seen as successful and what is not important. Furthermore, it has to be established when the observer is to observe.

EMAS for instance, requires the observation of performance and compliance aspects at least once a year. These annual revisions have to sum up to a revision of the whole management system in a three years time frame.

6.1.2 Learning and social interaction

As we have seen above, organizational learning is a social process. For the development of the environmental management system the interaction of the steering committee and the integrants of the environmental management system in general can be especially important. There is abundant research in social psychology on this topic. Research on minority influence can show that the information of minorities is weighted heavier when the opinion is expressed consistently and rests on support from others of the group etc. (Argote, 2005). (see also considerations of team learning, sharing of knowledge and knowledge generations of Argote (Argote, 2005) and Nonaka (Nonaka, 1994) developed above). Further an important set of group dynamics (Myer, 2008) (Greenberg & Baron, 2008) can help to increase the productivity and cohesiveness and efficiency in the introduction phase.

6.2 Capabilities in upheaval – or change

The creation of the Agenda Ambiental at the UASLP was developed as an organizational response to changes in the environment of the university that required multidisciplinary approaches and research for environmental issues. The organization observed a discrepancy between the external requirements and internal structure. The required multidisciplinary coordination was not able to be coordinated functionally with the existing organizational structure. The changes of the environment were not mandatory like in the case of Swedish universities (Arvidsson, 2004) where certain laws made the creation of environmental management systems mandatory. The project of the Agenda Ambiental was more driven by ideas and ideals. The Agenda Ambiental responds to requirements of the organizational environment but more than idea or requisite it follows an idea of transformation. The idea of innovation and transformation connects with intentional rational planned change.

One central aspect of the Agenda Ambiental in general and of the environmental management system in particular is the creation of sensitivity for environmental aspects of all members of the university (i.e. students, staff and professors). AUMA – one of the strategic programs of the Agenda Ambiental - and the module 12 of the environmental management system, which is concerned with communication and education corresponds to this aspect of sensitivity creation. In the terminology of this thesis we might say that we create and invest in absorptive capacity in the sense of Cohen and Levinthal (Cohen & Levinthal, 1990) but also try to influence the organization in Kurt Lewins theory of field forces (Remage & Shipp, 2009) (Armenakis & Harris, 2009) with the change cycle of unfreezing, moving and refreezing. In the sense of Armenakis (Armenakis & Harris, 2009) we could say that the Agenda Ambiental intentionally wants to create readiness for change.

In the developed model we proposed and predicted that dynamic capabilities evolve in an organization and we have found evidence that dynamic capabilities evolved in the case of the environmental management system of the UASLP. Through the externalization of implicit knowledge (Nonaka, 1994) and the codification of this knowledge (Zollo & Winter, 2002) it entered into the written organizational memory.

In the description of the specific methodology of module one we can see the idea of structure creation. The application of the dynamic capability leads to decisions. These decisions generate structure in the form of position descriptions, communication paths, decision premises like conditional programs, etc. This process-oriented organization in operational structure is different from the hierarchical structure that we have seen earlier. The operational aspect highlights a generative aspect. The dynamic capability or the specific methodology gives the answer to what the steering committee intentionally wants to let emerge in the auditable unit.

It is not part of this paper to make a comprehensive list of aspects that are complied with and aspects that deviate from the environmental management standard, that we have at the UASLP in comparison to EMAS or ISO. It is, however part of our work to consider the aspect of design and deliberate learning for dynamic capabilities in the sense of Winter (Winter, 2003). The question what structure we want to leave in the auditable unit. This would make it a deliberate decision if we want a system of controlled documents, structured written organizational memory in form of registers, employee or student participation in the maintenance of the system, crossed audits to be installed in the organizational subunits or not. This also could give the possibility to test these, perhaps, desirable aspects within the regular implementation process and see if organizational resistance arises. This would make it observable and measurable and could lead to a deliberate decision if the costs that a special aspect might bring to overcome organizational resistance are worth the effects. Furthermore, this could lead to systemic consideration of which changes could be done elsewhere to enable change, etc.

The resource-based view puts focus on competences and capabilities as these capabilities can be transformed into a variety of products (Teece, Pisano, & Shuen, 1997). These capabilities express the “historically evolved potential of the organization to combine resources with routines and organizational norms and values” (Hölzner, 2009). Capabilities by this include an aspect of system rationality. The creation of dynamic capabilities can be

especially important in organizations that are loosely coupled systems like universities (Weick K. E., 1976).

7 Limitations and further research

The focus of this research was to explore concepts of system theory, organizational learning and change management in the context of environmental management systems in universities. We developed a preliminary model and applied it to the case of the environmental management system at the Autonomous University of San Luis Potosí in Mexico.

The research has several limitations:

- First the application to only one university does not allow generalization of the findings.
- We have executed only a rather small base of interviews that cannot withstand rigor criteria.
- The secondary data review did not include the revision of the whole organizational memory of the environmental management system.
- Findings were not systematically triangulated.
- The researcher has no previous experience or training in interview techniques.
- On the conceptual, theory based side the exploration of a wide range of disciplines was given preference before rigorous theory compatibility.
- We did not develop science theoretic considerations either on the side of theoretic work or on the methodological side.
- The limited age or maturity of the environmental management system of the case university may limit the explicatory value further.

In a rigor vs. relevance debate we clearly located this research on the relevance side whereas the rigor might have suffered. On the other side in a multidisciplinary vs. dilettantism debate we hope to be still located on the multidisciplinary side.

We see great potential for the development to work further on the ideas that are detailed above. Each and every position that was developed would require testing and should be developed with scrutiny and in response to the deficiencies that our research suffers. Especially the explicative value of convergence and upheaval that we have proposed in our model cannot be developed in the analysis of only one organization. For this a different and better-developed methodology would be required. We consider that this would give sufficient research opportunity for a doctoral thesis.

8 Conclusions

Organizations are responsible for important environmental impacts around the world. Environmental management systems can help increase the environmental performance of organizations. We feel that the discourse centers mainly on the “hard factors”, on the technical side of operation within the organization. Within this thesis we wanted to explicitly explore another aspect of organizations. Organizational theory can help to get aware of the complexity that exists in organizations. To abstract from this complexity may jeopardize implementation success for environmental management systems. Further, operational excellence of the implemented environmental management system may suffer when it is limited only to technical aspects or to legal compliance. To open the door to complexity may on the other hand be frustrating. To recognize that the world is complex and the future uncertain, and that this uncertainty can only be limited through the reduction of complexity and with this, we will lose the possibility of truth, is not attractive either.

We tried to review literature and research streams like sociology, psychology, change management, organizational learning, environmental management standards that may help to “live with what there is”, although, the found complexity of organizational reality and theory makes it impossible to regain certainty and truth.

Besides the obvious limitations of the research and the resulting limitations in the trustworthiness of the findings, we feel that a complexity based access that builds on concepts from system theory, change management and organizational learning can expand considerations towards environmental management systems in general and environmental

management systems at universities in particular might be of help for environmental management system implementations.

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